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# CHILD DEVELOPMENT





PUBLISHED QUARTERLY BY THE SOCIETY FOR RESEARCH IN CHILD DEVELOPMENT
NATIONAL RESEARCH COUNCIL
2101 CONSTITUTION AVENUE
WASHINGTON, D. C.
*Made in United States of America*

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## *Editorial Board*



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# THE NATURE AND CHARACTER OF PRE-ADOLESCENT GROWTH IN READING ACHIEVEMENT

CECIL V. MILLARD[1]

CONTENTS



## INTRODUCTION

The point of view which considers the skill subjects as tools to be used in an experiential setting is rapidly gaining widespread approval. Some recent courses of study go so far as to treat the acquisition of skill in the three "R's" as an incidental activity within a program based on the purposeful life activities of the child. Even in those schools where administrative regulations hold to the old regime, emphasis upon achievement has been greatly diminished. One must admit, regardless of whether he approves or disapproves, that education in terms of child growth rather than in terms of subject matter achievement is becoming a more and more popular concept. Many teachers now appraise their programs according to the contribution made to the social, emotional, and physical, as well as that made to the intellectual development of the child. Activities in reading and in other subjects, in the new program, become activities for the purpose of facilitating child growth.

Many conventional teachers, most parents, and perhaps even some teachers of the modern school of thought ask, "Does this mean, then, that achievement is being neglected?" The question is generally answered in the affirmative. Except in rare instances in which an attempt has been made to show that achievement is greater when subject matter units are introduced in situations only where there is need for their acquisition, the general view assumes that subject matter achievement is of secondary importance to the growth of the "whole" child.

The emphasis upon child development, in the new curriculum, indicates the need for successive measures of growth. Dissatisfaction has arisen with the conventional procedure of measuring at a given time all available

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subjects, classifying measurements into age groups, and computing mean values for each level. Investigators are now beginning to question the validity of the approach which assumes that the individuals in each age group are representative of what the individuals in preceding age groups will become in time. Although experimentalists, teachers, and administrators realize that grouped scores ignore the important factor of selection, massed statistics, norms and standards have developed a far reaching appeal. There exists today, then, an increasing need for studies based on successive measures of individual children. Successive measures enable the investigator to follow the child through various stages of growth and appear to offer valid data for an approach to the study of the development of the whole child.

A recognition of the need for this type of investigation is shown in the Harvard Growth Studies, the Iowa Studies, and in some private agencies for child study. Very little has been done, however, by those who have had the greatest responsibility in determining the type of environment surrounding the child, namely, the curriculum makers. Too few in this group have ever observed a complete cycle of development in, for example, a child's learning curve in reading.

What are the factors conditioning the learning curve in reading? What change results in the curve as the child progresses from one grade to another? What relation does intelligence have upon reading performance? The approach of this study involves a further consideration of certain of these problems.

## General Plan

The investigation has three purposes: 1) to determine individual differences in the development of reading achievement in children; 2) to discover the general pattern of growth of pre-adolescent reading; 3) to measure the effect of certain factors which affect reading development.

The period of measurement extends over a six year interval. Children included in the study range from those now in the fourth grade to those now in the tenth grade. All data used, however, were limited to those found within the pre-adolescent cycle of development.[2] Children used as cases were those for whom measurements covering at least a three year span were available.

## General Setting

Children attending the Henry Ford School, Dearborn, were utilized as subjects. Due to such reasons as absence, moving away, entering school in the middle grades, etc., the cases selected do not all have the same number of measures. No valid criticism can be made of this condition since the entire investigation is based upon a study of individual development.

The children in this school are, in general, typical of the higher level of social status found in an industrial community. Very few of the

[2] *A study concerned with adolescent effects will appear at a later date. Two criteria were used for the selection of data for each case. First, no data were included which overlapped the period marking the onset of puberty. Secondly, no data were included which alone appeared to indicate a well-defined second cycle of reading growth.*

cases represent social extremes.

The stringent criterion set up for the selection of cases - three years of consecutive measures preceding adolescence - naturally reduces the number of cases available. Although the number studied represents a comparatively small group, the one hundred and more children included should be regarded as one hundred and more case studies portraying a typical pattern of pre-adolescent growth in reading.

## PROBLEMS INVOLVED IN THE ANALYSES

### Units of Measurement

Ever since Wissler[3] used the newly developed Pearsonian technique, there has been an increasing use of the correlational method in determining relationships between various aspects of growth. By correlational procedures, relationships have been established between such aspects of growth as height and weight,[4] physical measures and mental measures, mental measures and achievement, and many other phases of human growth. Where single measures of groups of individuals were available, it has proven to be very adaptable, and many noteworthy applications have been made in the study of educational problems.

Successive measures on individual children present further possibilities for educational research. In the biological sciences, where cumulative data can easily be obtained, several methods for a mathematical expression of growth have been devised. In the main, most of these have their derivation in either of two types of curves called the logarithmic and the logistic. The main difference between the two is found in the location of their respective inflection points. In the logistic curve, the point of inflection lies halfway between the two points taken as the beginning and the end of growth. In the logarithmic curve, the inflection point is located nearer the beginning than the end.[5] In the logistic curve, the point lying to the right of the inflection point is the exact reversal of the half lying to the left. This characteristic implies that the forces acting during the second half of the cycle are equal in magnitude to the forces operating during the first half, and are similarly distributed in time. The logarithmic curve does not exhibit this symmetry.[6-7]

Both types of curves have been widely used in the biological fields. The honor for the introduction of a growth technique in educational research belongs to Courtis.[8] Courtis has isolated and identified factors which are essential elements of the growth process. By defining factors, he has been able to determine by scientific experimentation the laws which express the relation of these factors to growth.

[3]*Wissler, Clark. "The correlation of mental and physical tests," Monograph Supplements, III, No. 6. Princeton, New Jersey: Psychological Review Co., 1901. Pp. 62.*

[4]*Baldwin, Bird T. The physical growth of children from birth to maturity. Iowa City, Iowa: University of Iowa Studies in Child Welfare, No. 1, 1921. Pp. 411.*

[5]*In the standard curve, the inflection point is found at the point in the curve equal to* $\frac{1}{e}$.

[6]*Pearl, Raymond, and Reed, Lowell J., "Skew-growth curves," Proceedings of the National Academy of Sciences, XI, January, 1925, 16-22.*

[7]*Winsor, Charles P., "A comparison of certain symmetrical growth curves," Journal of the Washington Academy of Sciences, XXII, February, 1932, 73-76.*

[8]*Courtis, S. A., "The measurement of growth." Ann Arbor, Michigan: Brumfield and Brumfield, 1932. Pp. 155 + 62.*

The claims of the Courtis technique over other mathematical expressions of growth may be summarized as follows:[9]

(1) The meaning of the various constants has been scientifically determined;

(2) Fundamental laws or generalizations have been embodied in a simple manner within an analytic expression or rational equation;

(3) A natural unit has been employed which is constant at all points of the scale of measurement, under the conditions of the assumptions underlying its development.

In utilizing the growth technique, a unity of measurement which affords a convenient basis of comparison of developments is "time". Common observation indicates that differences exist in the "times" of different growths to achieve maturity. An oak tree has a longer maturation period than a flower. Educators are familiar with the differences among children in the "time" required to reach a given mental development. For example, it takes the "dull" child a much longer period of time than a "normal" child to reach a mental development of ten years.

In educational diagnostic procedures, the I.Q. is generally utilized as a ratio characterizing the amount of mental growth achieved at a given time. There is no reason, however, why the I.Q. should not be determined by ratios between the "times" necessary to reach a given mental development. The advantage of the conventional I.Q. lies in the convenience with which it can be obtained by a single intelligence testing. Its disadvantage is found in its variability.[10] For example, in cases 24F and 42F (Figure 1), the ratios between the mental ages of the two children range from 1.71 to 1.23 over a period of forty months. This variation, as well as the variation in the I.Q.'s themselves, from 110 to 132 for case 24F and from 73 to 91 for case 42F, results from differences in ages at which mental growth begins, from differences in the maximum amount of growth to be achieved, and from differences in ratios of growth. In determining the I.Q., in the conventional manner, none of these characteristics of individual growth are given proper consideration. In general, the I.Q. represents a measure of the effect of a combination of factors without due regard being given to their specific effect upon growth.

It may not be known generally that in a given test of, for example, 100 items, not all children will approach the same maximum. It is usually assumed that all children eventually will be able to respond correctly to each test item. This is not the case. If measurement of a given child is continued periodically year after year, observation of the resulting curve will show a rounding off of the curve at a definite point, perhaps at a score of 80. Another child's scores may be found to round off at an entirely different point, possibly twenty points or more lower. Thus equal scores at a given time for these two children, although of the same magnitude at one time, have entirely different mean-

[9] *Millard, C. V., Factors conditioning performance in spelling. Ann Arbor, Mich.: University of Michigan Research Monographs, 1937. Pp. XI + 207.*

[10] *The second monograph in this series will portray the character of mental development in a large number of individual children.*

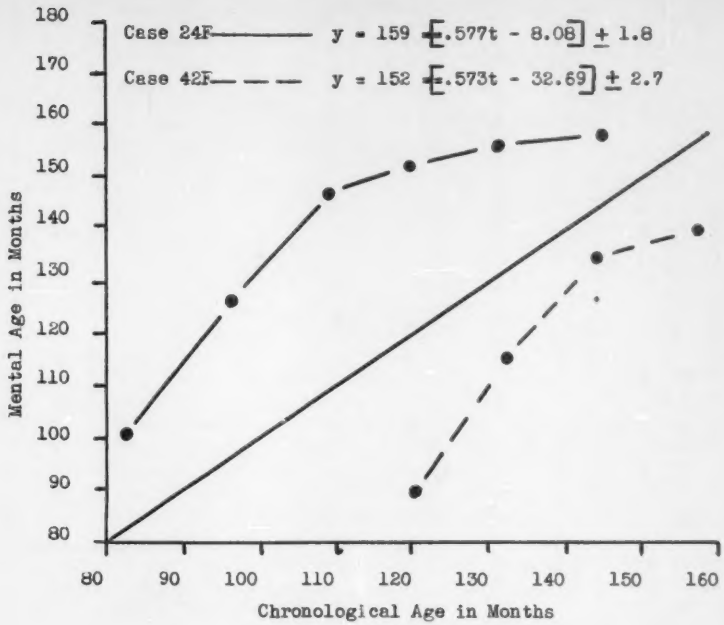



Fig. 1. Comparison of Mental Developments of Two Girls with widely varying I.Q.'s.

Observed I. Q.'s

| 24F | 42F |
|---|---|
| 132 | 73 |
| 137 | 87 |
| 134 | 91 |
| 126 | 90 |
| 110 | |

Ratios between Mental Ages Computed from Equations:

| Age | Mental Age | | Ratios |
|---|---|---|---|
| | 24F | 42F | |
| 120 | 152.0 | 88.5 | 1.71 |
| 130 | 154.5 | 110.0 | 1.40 |
| 140 | 157.0 | 127 | 1.23 |

Ratios between rates: 1.007

Note: These two widely differing children are growing at approximately equal rates.

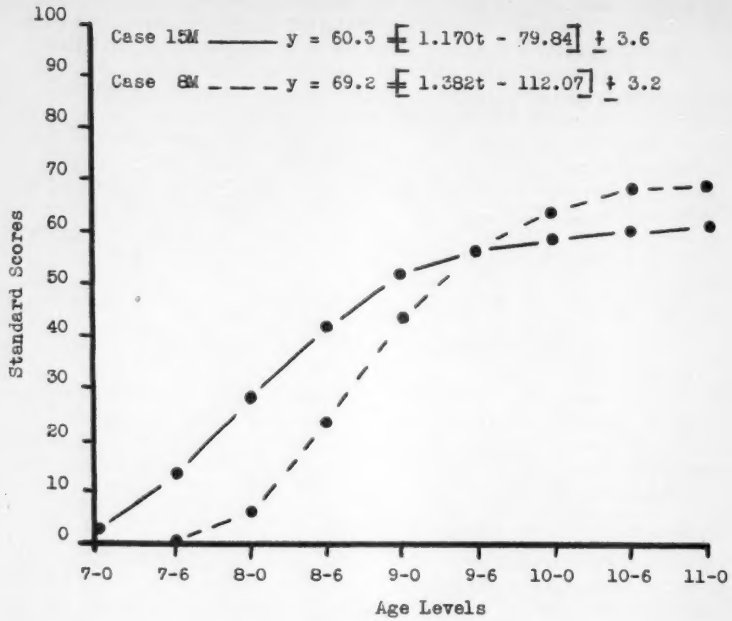



Fig. 2. Comparison of Reading Curves of Two Boys of Equal I.Q. (Showing the Fallacy in Matching Pupils on the Basis of Equal Performances at Any One Given Time).

Difference in Status (Stanford Scores)
(Constantly Varies)
Which is the Superior Child?

| Age | 15M | 8M | Difference |
|---|---|---|---|
| 90 | 12.4 | .2 | + 12.19 |
| 96 | 27.6 | 5.4 | + 22.2 |
| 102 | 40.9 | 22.7 | + 18.2 |
| 108 | 49.8 | 42.3 | + 7.5 |
| 114 | 55.0 | 55.0 | 0.0 |
| 120 | 57.5 | 63.2 | - 5.7 |
| 126 | 58.9 | 66.5 | - 7.6 |
| 132 | 59.6 | 68.0 | - 8.4 |

Ratio Between Rates: 1.170 divided by 1.382, or .836
Note: 8M is superior in rate of growth.

ings when considered in terms of the maxima toward which the children are growing (Figure 2). In the conventional procedure, equal scores at a given time would be regarded as equivalent achievements. The differences in achievement which would be noted on a later testing might be attributed to the effect of some other factor, for example, teaching. As a matter of fact, in the examples shown in Figure 2, the differences in scores found at the later dates are the result of factors which were in operation throughout the entire growth cycle. Thus it would not be difficult to show that great injustice is done many children by comparing their scores, or measurements with measures of central tendencies which do not take into account the various factors in the developmental process which the scores represent.

In the growth technique, magnitude scores are used in analysis only as they are expressed as percentages of the maximum achieved at maturity.[11]

### The Unit of Measurement A Measure of Quality

As has already been indicated, differences between individuals express themselves in three ways in growth, other things being equal: 1) in differences in development at the beginning of a growth cycle. This characteristic of growth is called incipiency and in the equation may be utilized in determining at what age the growth in a given cycle begins; 2) in differences in the maximum attained at maturity of a given cycle; and 3) in differences in the rate of growth.

When different children, or different groups of children, have the same development at the beginning of a cycle (incipiency), and are growing toward the same maximum, differences in quality may be ascertained by a comparison of rates of growth. Since the growth equation states exactly the amount of isochronic growth achieved in a given time unit, the "quality" relationship may be determined mathematically from the equation,

$$\frac{q_1}{q_2} = \frac{r_1}{r_2}$$

Quality then becomes similar to what is commonly called intelligence or brightness. However, under the conditions governing the use of the growth treatment, quality differs from the I.Q. in that it is constant at every point of growth within a given cycle.

In the procedure followed throughout this study, the effect of factors was determined by comparing differences in time consumed to reach a given maturity. In this connection the term "Developmental Ratio" is used.[12] In computing the developmental ratio, it is not necessary to compare the total lengths of the period of maturation. Comparison of the "times required to achieve equal developments" will yield the same result. Expressed mathematically (other things being equal), Developmental Ratio (D. R.), is inversely proportional to the "times", T, required for equal development. Or

[11] See Courtis, S. A., *ibid; pp. 108-119, for computation of maxima.*

[12] *Proposed by Courtis, S. A., The measurement of growth. Ann Arbor, Brumfield and Brumfield.*

$$\frac{\text{D. R. (Individual)}}{\text{D. R. (Group)}} = \frac{\text{T (Group)}}{\text{T}_2\text{ (Individual)}}$$

### Procedure Followed

Courtis has shown that all growth follows a standard pattern of development. Does this mean, then, that growth in height, growth in mental development, and growth in achievement follow comparable patterns? Can various aspects of growth in one type of development be predicted from aspects of growth in an entirely unrelated type of development? Can relationships comparable to an I.Q. be determined from a knowledge of a child's growth in reading, or from a knowledge of the character of his growth in height?

It is the purpose of this study to compute growth equations in reading for all available cases, and to study the relationship of the individual D. R. to the individual maxima achieved.[13] Other problems involve a prediction from the reading scores of a relationship comparable to the I.Q., as well as to point out techniques for the measurement of the effect of factors which influence growth in reading achievement.

In a problem of this kind, the method of procedure is to advance from the known to the unknown. Although the I.Q. represents in many respects an unreliable relationship, it is at present our best known and most widely used index of mental development. Therefore, certain of the procedures followed will involve the computation of "indices" of reading achievement which may be compared with individual I.Q.'s.

## MEASUREMENT OF READING ACHIEVEMENT

### Treatment of Data

Data used for analyses consisted of Stanford reading scores for fifty-five boys and for sixty-two girls. For this group of one hundred seventeen children, five hundred seventy-six reading scores were available. All children were in attendance in the Henry Ford School for at least three years, and all scores were taken at the pre-adolescent level.[14]

### Plan of Procedure

The following plan was used in consolidating individual data:

Step 1. An equation for the growth of each individual was derived from the actual measurements (Appendices A and B).

Step 2. These equations were solved for values for each individual at the ages at which the tests were given.

Step 3. Comparisons were then made between the computed values and the actual values obtained on the tests.

[13] *Scores used represent the average interpolated score of paragraph meaning and word meaning, as indicated by Stanford scoring instructions.*

[14] *See definition on page 72.*

## Adequacy of the Equations in Describing Growth in Reading

Many people will find it hard to believe that it is possible to describe a child's growth in reading in exact mathematical terms. The equations derived, however, picture the entire reading development through approximate third, fourth, and fifth grade levels within a mean deviation of less than ± 3.0 points from the actual measured performances. Human behavior is usually viewed as erratically variable; but among the one hundred eighteen children available for case analysis, only two showed enough variation in reading performance to complicate the computation of a reasonably accurate performance.

The answer to the question as to the adequacy of the growth technique in describing reading performance is found in a study of the deviations of predicted performance from observed performance (Figure 3).[15] The total number of predictions made was 576. Approximately one-third of the errors were found to be less than ± 1.0 from the actual measures. In view of the conditions which tend to produce unreliable test results, such as unreliability in the test itself, the varying effects of teaching as the child goes from grade to grade, variation in health, etc., it seems remarkable that individual performances follow such a regular pattern of development.

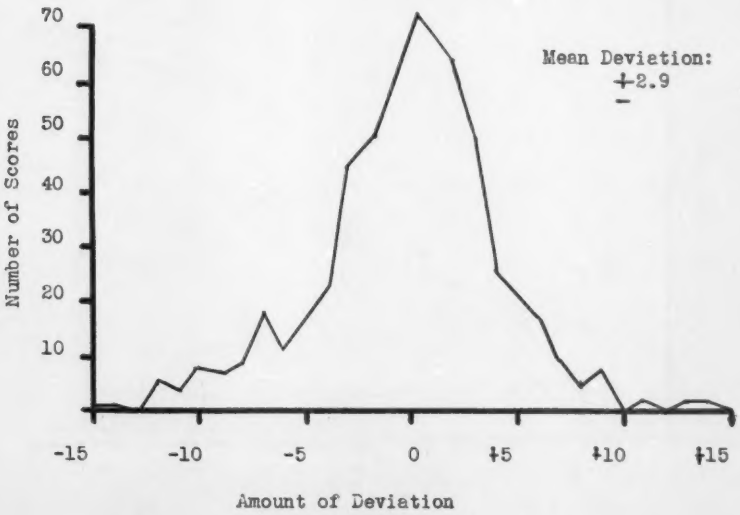



Fig. 3. Distribution of Deviations of Predicted Reading Scores from Actual Stanford Measures (Showing Distributions by Sign of Deviation).

[15] *Appendix C illustrates the fit of the curves with observed performance. The values are expressed as logarithmic in order better to illustrate the rounding off of the curves toward a definite maximum.*

Ignoring signs (+ or -), the average deviation for the whole group was found to be ± 2.9. Considering sign, the mean deviation was found to be zero.

### Comparison of Stanford Norms with Boys' and Girls' Curves of Constants

Following the procedure outlined by Courtis,[16] "Curves of Constants" were determined for both boys and girls as follows: Utilizing the ensuing equations, boys' and girls' scores were computed at half-year intervals from seven to eleven, inclusive (Table 1, Figure 4).

$$\text{Boys: } y = 74.7 = [1.123t - 82.20]$$
$$\text{Girls: } y = 75.3 = [1.212t - 87.26]$$

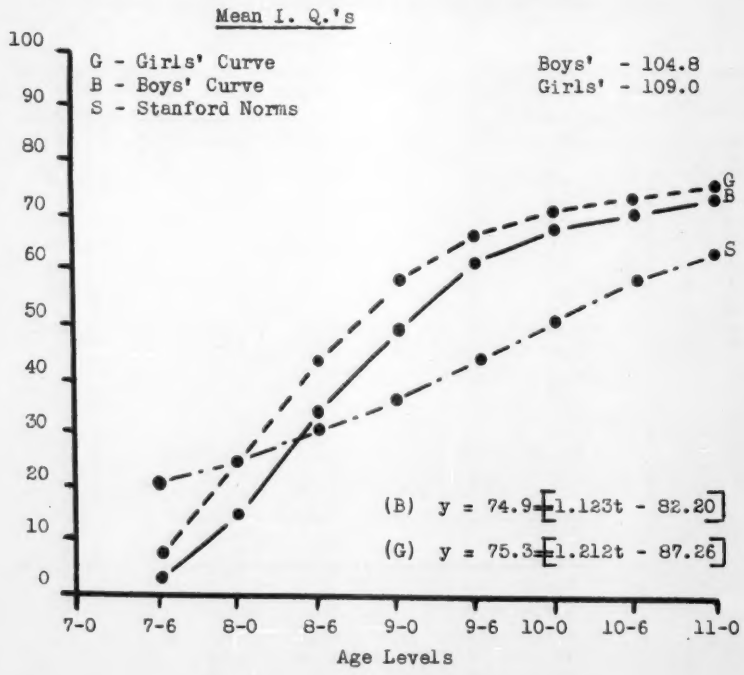



Fig. 4. Comparison of H. F. S. Achievement in Reading with Stanford Norms. (Achievement computed from mean constants of equations).

[16] *Courtis, S. A., "The derivation of norms," Section Q. Education, American Association for the Advancement of Science. 1932, pp. 237-242.*

The conventional method of determining reading efficiency is to calculate the reading quotient, (R.Q.) which is obtained by dividing the reading age[17] by the chronological age. Utilizing the educational ages, shown in Table 1, reading quotients were calculated (Table 2).

It is interesting, although somewhat disconcerting to the conventionally minded diagnostician, to notice the constant shift of the reading quotient for both boys and girls. Were these reading quotients representative of different boys and girls at each of the various grade levels, the shifting values might have been attributed to differences in ability, or perhaps teaching differences might have been held responsible. Neither of these explanations is tenable, for the various grade levels represent the same children tested as they progressed from grade to grade.

TABLE 1

COMPARISON OF HENRY FORD SCHOOL BOYS' AND GIRLS' READING SCORES WITH STANFORD NORMS

| Grade | Age | Stanford Norms | | H. F. S. Boys' Scores | | H. F. S. Girls' Scores | |
|---|---|---|---|---|---|---|---|
| | | Score | Ed. Age | Score | Ed. Age | Score | Ed. Age |
| 2 - A | 7-6 | 21 | 90 | 3.5 | * | 7.8 | * |
| 3 - B | 8-0 | 25 | 96 | 15.83 | 82 | 25.1 | 96.5 |
| 3 - A | 8-6 | 31 | 102 | 33.8 | 104 | 44.3 | 114 |
| 4 - B | 9-0 | 37 | 108 | 49.8 | 119 | 58.2 | 126 |
| 4 - A | 9-6 | 44 | 114 | 60.8 | 128 | 66.5 | 134 |
| 5 - B | 10-0 | 51 | 120 | 67.2 | 135 | 70.9 | 138 |
| 5 - A | 10-6 | 58 | 126 | 70.8 | 138 | 73.1 | 141 |
| 6 - B | 11-0 | 64 | 132 | 72.7 | 140 | 74.2 | 142 |

* Educational Ages not given for scores under 10.

TABLE 2

READING QUOTIENTS* OF H. F. S. BOYS AND GIRLS AT VARIOUS AGES

| Grade | Age | (R.Q.) Boys | (R.Q.) Girls |
|---|---|---|---|
| 3 - B | 8 - 0 | 85.4 | 100.5 |
| 3 - A | 8 - 6 | 101.9 | 111.7 |
| 4 - B | 9 - 0 | 110.1 | 116.6 |
| 4 - A | 9 - 6 | 112.2 | 117.5 |
| 5 - B | 10 - 6 | 112.5 | 115.0 |
| 5 - A | 10 - 6 | 109.5 | 111.1 |
| 6 - B | 11 - 0 | 106.0 | 107.5 |

*R. Q. = $\frac{\text{E. A.}}{\text{C. A.}}$

[17]See Stanford Norms.

As a last defense, the conventional analyst might attribute the shifting to variations in conditions underlying the testing program. The fact remains, however, that growth as represented by these children closely approximates a regular, curvilinear development from grade to grade.

The reading quotient, to be valid, should show uniformity from grade to grade when development is as regular as here pictured. The variability of the reading quotient is due to the fallacy in the conventional basis of interpretation which allows a comparison of the growth of individual children with a so-called norm constructed from test scores of a large number of children, where no factor except age is kept under control. The Curves of Constants (Figure 4), and the individual curves, illustrate the fact that growth in reading presents certain curvilinear characteristics which are not comparable with the approximate straight-line norms of the Stanford Tests.

## Conclusion

It is interesting to note that at 8 - 0 years of age for girls and at 8 - 6 years of age for boys, performances of the Henry Ford School children, below "normal" before this time, reach and surpass the reading norms. Reading quotients (Table 2), obtained from the educational ages of the Henry Ford School children (Table 1), show but little constancy ranging from below 85.4 to 112.5 for boys, and from below 100.5 to 117.5 for girls. Since this ratio is often used to determine reading efficiency, the results shown here illustrate the fallacy of the scheme. Since this method of measuring achievement has been advocated by almost all leading writers on educational diagnosis, until it has become almost universally practiced, the injustice done thousands and thousands of pupils by this procedure is illustrated by these data.

Another grave injustice which is almost as prevalent can likewise be illustrated here. Utilizing the achieved scores of the Henry Ford School children, the interpretation ordinarily made would be that teaching at the levels where the R. Q. is highest, for boys in grades 4A and 5B, and for girls in grades 4B and 4A (Table 2), is responsible for the high achievement. Nothing could be further from the truth! Performance achieved at these levels can be accurately predicted from scores at lower grade levels. Consequently the factors which brought the scores to their highest point above the norm are factors which were already in operation throughout the early part of the curve.

The conclusion must be made that the concept of norms needs revision. Evidence such as shown in this chapter points out the injustice done many children by comparing their scores with so-called norms which take no account of individual differences in growth.

## SEX DIFFERENCES IN READING PERFORMANCE

Probably no other phase of the school curricula has induced as much research as has the field of reading. Individual differences have been studied. The effect of intelligence upon reading performance has been investigated time after time. Methods of teaching children to read have been devised, applied, and appraised, and the physiological implications

of reading performance have received intensive study. As yet, however, few outstanding investigations have been made of sex differences in reading. One would certainly not be labeled an extremist, in view of these facts, to say that sex as a factor in reading performance has not been regarded as significant. Whether or not sex differences have been justifiably ignored remains to be seen. In other curricular fields, the effect of sex has been studied. Numerous investigators have carefully analyzed sex differences in spelling. In various phases of arithmetic, differences in the performance of boys and girls have been given considerable attention.

Our tendency today to make the best possible provisions for the individual child necessitates, to say the least, some attention to the effect of sex upon reading performance. The problem of reading readiness with its implications regarding the time at which formal reading should be introduced, suggests probable sex differences, as well as individual differences. The superior physical maturity of girls over boys at the upper elementary grade level suggests the possibility of an accompanying reading superiority. The problem receives added import when looked at from the point of view of child development. Certainly no investigator today, in the field of child study, would think of combining boys' and girls' scores in studying the effects of factors conditioning growth. If boys' and girls' measures are to be treated singly, what are the differences, then, that characterize the development of each?

The objective of this chapter is to analyze differences in the reading scores of boys and girls at the pre-adolescent level, and to study mathematically the relationships which are produced by such differences as may occur.

## Treatment of Data

Subjects: Two different groupings of boys and of girls were available for this phase of the investigation.

1. All boys (55) and all girls (63) as shown in Appendices A and B;
2. Boys and girls (43 pairs), matched according to their I.Q.'s, as shown below:

| Pair | Cases: Case Numbers Boys-Girls | Approximate I.Q. |
|---|---|---|
| 1 | 36 - 17 | 85 |
| 2 | 23 - 33 | 90 |
| 3 | 24 - 7 | 90 |
| 4 | 35 - 42 | 90 |
| 5 | 21 - 51 | 95 |
| 6 | 60 - 48 | 95 |
| 7 | 37 - 1 | 100 |
| 8 | 95 - 80 | 100 |
| 9 | 48 - 29 | 100 |
| 10 | 61 - 31 | 100 |
| 11 | 16 - 43 | 100 |

Cases (Continued)

| Pair | Case Numbers Boys-Girls | Approximate I.Q. |
|---|---|---|
| 12 | 71 - 9 | 105 |
| 13 | 11 - 18 | 105 |
| 14 | 45 - 26 | 105 |
| 15 | 8 - 64 | 105 |
| 16 | 15 - 21 | 105 |
| 17 | 19 - 78 | 105 |
| 18 | 26 - 32 | 105 |
| 19 | 27 - 52 | 105 |
| 20 | 34 - 28 | 105 |
| 21 | 31 - 71 | 105 |
| 22 | 42 - 3 | 105 |
| 23 | 70 - 59 | 105 |
| 24 | 77 - 65 | 105 |
| 25 | 22 - 41 | 110 |
| 26 | 44 - 68 | 110 |
| 27 | 1 - 15 | 110 |
| 28 | 2 - 49 | 110 |
| 29 | 3 - 70 | 110 |
| 30 | 13 - 82 | 110 |
| 31 | 14 - 69 | 110 |
| 32 | 52 - 13 | 110 |
| 33 | 18 - 38 | 110 |
| 34 | 46 - 5 | 110 |
| 35 | 40 - 12 | 115 |
| 36 | 41 - 4 | 115 |
| 37 | 51 - 62 | 115 |
| 38 | 9 - 74 | 115 |
| 39 | 10 - 77 | 115 |
| 40 | 17 - 19 | 115 |
| 41 | 28 - 25 | 120 |
| 42 | 12 - 35 | 120 |
| 43 | 49 - 55 | 125 |

Mean I.Q. - 106.1

Method of Analysis: Utilizing the equations of constants (p. 80), scores were computed at regular age intervals and comparisons were made in terms of score, rate of growth, the age established for the beginning of growth (b), the age established for the completion of growth (t), and the time required for growth (c).[18]

[18] *In applying the growth technique to successive performance measures, it is not necessary to match children according to age, since the growth equation derived describes growth throughout the entire cycle. The isochronic equation regards growth at any part of the learning curve as equal to growth at any other part, providing the unit of time is the same throughout. Therefore, growth at the upper part of one learning curve can be compared with growth at an entirely different part in another curve, other things being equal, or when other differences in conditions underlying the two growths are known or measurable.*

## Results

(1) Comparison of Reading Scores of Unmatched Boys and Girls: According to the scores computed from the equations

$$y = 74.9 = [= 1.123t - 82.20] \text{ - Boys}$$
$$y = 75.3 = [= 1.212t - 87.26] \text{ - Girls}$$

of the means of constants, the reading performance of girls is superior at each age level throughout the cycle (Figure 4). From the conventional point of view, the greatest difference is found at the age of eight years and six months. At this age the girls' score exceeds the boys' by more than ten points (Table 3). A comparison of the educational ages achieved shows the greatest superiority in favor of the girls to be found at the age of eight years (Table 3). Ratios between isochronic developments[19] show a degree of uniformity in achievement which is not shared by either the Stanford scores or the educational ages (Table 3).

Since the maxima toward which the two groups are developing are approximately equal, 74.7 for boys and 75.3 for girls with a ratio of 1.00 (Table 3), the possibility is available of making comparisons mathematically with the "K" in the equation, $y = K = [= rt \pm i]$, eliminated. The equation then becomes $y = rt \pm i$.

Since "t" is a common element in both equations, and since the values for "i" are only used to express differences in time at which growth begins, a measure, in this instance, is available which expresses throughout the entire development a consistent measure of the superiority of girls over boys, namely, the ratio of the rates of growth. For these two groups this ratio is found to be 1.079 (Table 3). Another available measure, described previously as the developmental ratio (D. R.), is also utilized. This value, 1.08, is consistent with the rate ratio shown above.[20] The developmental ratio shows that the girls require a shorter growth period than the boys. Expressed precisely, the D. R. is inversely proportional to the time required for equal developments.

Other differences in the character of the two curves remain to be described. As indicated by the mean "i" in the equations, the girls begin the cycle of development at a mean age of 72 months, whereas the boys begin this particular reading growth at a mean age of 73.2 months, a difference of slightly more than one month (Figure 6B). A difference of six months is found, however, between the mean ages at which the two groups arrive at maturity (mathematically computed at 99 per cent of maturity) (Figure 6D). Other differences, maximum growth and time required for maturation are not significant (Figures 6A and 6C).

In the section immediately preceding, it was pointed out that differences were found to exist in the reading achievements of the two groups which were distinctly in favor of the girls. The two groups were not equal in number, nor were they of equal intelligence. In the second phase of this study the effect of intelligence was controlled by utilizing the scores of the forty-three matched pairs. By averaging the

[19] *The "developments" are the values obtained from the portion of the general equation, $y = K = [= rt + i]$, found within the brackets $= [= ]$. Developments do not make allowances for differences in maxima (K) and must not be utilized unless maxima are equal, or differences accounted for.*

[20] *D. R. obtained by dividing the boys' age at which the cycle is completed by the girls' age involves a comparison of the times required to make equal developments.*

TABLE 3

DIFFERENCES IN READING PERFORMANCE OF H. F. S. BOYS AND GIRLS AT VARIOUS AGE LEVELS. UNMATCHED GROUPS

| Ages | Score[1] | | | | Educational Age[2] | | | | Isochronic Development[3] | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Girls | Boys | Diff. | Ratios (G ÷ B) | Girls | Boys | Diff. | Ratios (G ÷ B) | Girls | Boys | Diff. | Ratios (G ÷ B) |
| 7-6 | 7.8 | 3.5 | 4.3 | 2.22 | — | — | — | — | 21.82 | 18.87 | 2.95 | 1.15 |
| 8-0 | 25.1 | 15.8 | 9.3 | 1.58 | 96 | 82 | 14 | 1.15 | 29.09 | 25.60 | 3.49 | 1.13 |
| 8-6 | 44.3 | 33.8 | 10.5 | 1.31 | 114 | 104 | 10 | 1.09 | 36.36 | 32.34 | 4.02 | 1.12 |
| 9-0 | 58.2 | 49.8 | 8.4 | 1.16 | 126 | 119 | 7 | 1.05 | 43.63 | 39.08 | 4.55 | 1.11 |
| 9-6 | 66.5 | 60.8 | 5.7 | 1.08 | 134 | 128 | 6 | 1.04 | 50.90 | 45.82 | 5.08 | 1.11 |
| 10-0 | 70.9 | 67.2 | 3.7 | 1.05 | 138 | 135 | 3 | 1.02 | 58.18 | 52.56 | 5.62 | 1.10 |
| 10-6 | 73.1 | 70.8 | 2.2 | 1.03 | 141 | 138 | 3 | 1.02 | 65.45 | 59.29 | 6.16 | 1.10 |
| 11-0 | 74.2 | 72.7 | 1.5 | 1.02 | 142 | 140 | 2 | 1.01 | 72.72 | 66.03 | 6.69 | 1.10 |

[1]Score - Computed from Equation of Curves of Constants. [2]Educational ages found by referring computed scores to the Stanford norms. [3]Isochronic Development determined from Equation of Curves of Constants.

I. Q.'s: Boys - 104.8; Girls - 109.0; Ratio (G ÷ B) = 1.04

Constants in Equations

| | | | | |
|---|---|---|---|---|
| a. | Rates of Growth . . . . | Boys - 1.123 | Girls - 1.212 | Ratio (G ÷ B) = 1.079 |
| b. | Beginning of Growth . . . | Boys - 73.2 mos. | Girls - 72.0 mos. | Diff. (B - G) = 1.2 mo. |
| c. | Time required for Growth. | Boys - 70.2 mos. | Girls - 65.0 mos. | Ratio (B ÷ G) = 1.08 |
| d. | Age at Completion of Growth . . . . . | Boys - 143 mos. | Girls - 137 mos. | Diff. (B - G) = 6.0 mo. |
| e. | Maxima. . . . . | Boys - 74.7 | Girls - 75.3 | Ratio (G : B) = 1.00 |

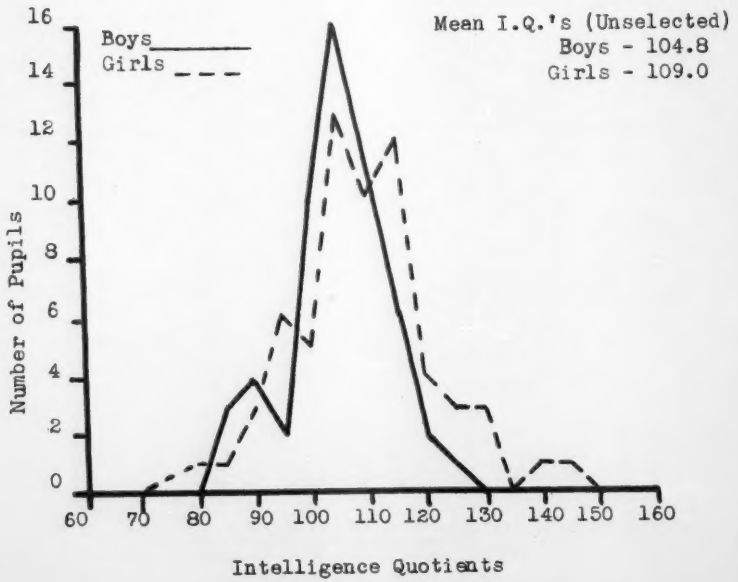



Fig. 5. Distribution of I.Q.'s by Sex. Unmatched Boys and Girls.

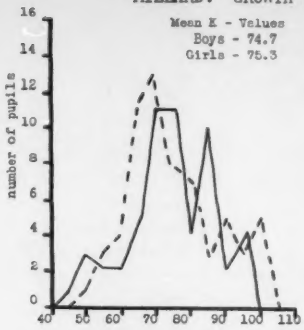



Figure 6A. Sex Differences in K - Values

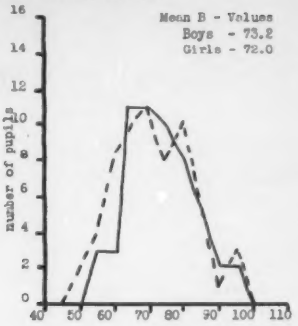



Figure 6B. Sex Differences in Age of Beginning Reading

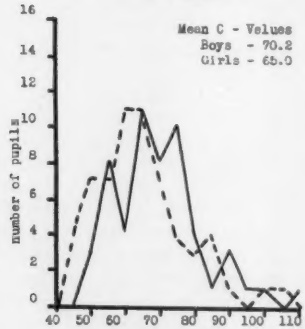



Figure 6C. Sex Differences in Time Required for Complete (99%) Maturation

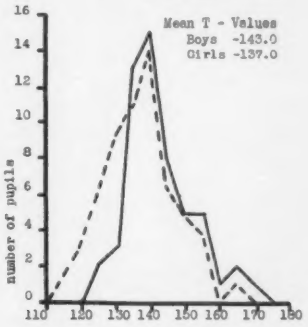



Figure 6D. Sex Differences in Ages at Which Complete (99%) Maturation Occurs

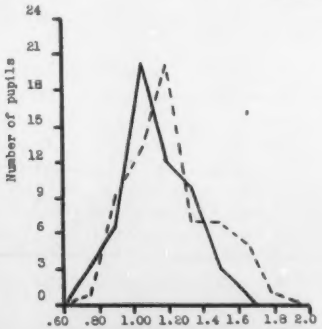



Figure 6E. Sex Differences in Rates of Growth

Fig. 6. Sex Differences in Pre-Adolescent Reading Constants (Unmatched Boys and Girls). Boys _____ Girls _ _ _ _ _

constants in the equations of these children, the following equations resulted:

$$y = 75.96 = [= 1.144t - 83.51] - \text{Boys}$$
$$y = 73.21 = [= 1.192t - 86.53] - \text{Girls}$$

Using these equations in computing scores at various ages throughout the cycle, quite marked changes in results are found from those obtained with the unmatched groups.

From the conventional diagnostic approach, it would be necessary to conclude from these latter data that girls are better readers in the earlier elementary grades, but that the boys catch up with and pass the girls at the later elementary levels (Table 4, Figure 7). At eight years of age girls are five months advanced over boys in reading achievement. This superiority gradually decreases until age ten is reached, at which time the boys show superiority in reading achievement.

If the achievements are now considered from the "growth" point of view, very consistent conclusions are obtained, in spite of complications due to equation differences in the maxim toward which the two groups are growing.[21]

The isochronic ratios (Table 4), show a slight variation in the superiority of the girls ranging from four to six per cent. In comparing the growth equations of these two groups, it is found that the starting times are practically equal (Table 4, Figure 9), there being a difference of only 0.4 of a month. With equal starting points the isochronic developments would have provided an accurate comparative developmental measure had the two groups been growing toward the same maximum. Since the two groups do not have the same maximum, the isochronic developments do not express an accurate ratio between the two growths. Likewise, since the "K's" in the equations are not equal, "K" cannot be eliminated from consideration as in the diagnosis of the unmatched groups. Therefore, neither the developmental ratio as determined by the rate ratios (1.041 in Table 4), nor the developmental ratio as determined by the ratio between the "times" required for equal developments, (from Table 4

$$\frac{142.1 \text{ (Boys' Age at Completion of Growth )}}{138.5 \text{ (Girls' Age at Completion of Growth)}} = 1.041)$$

can be used as measure of comparative developments.

To interpret differences in the two growths accurately, allowances must be made for the different maxima. Regardless of rates of growth and time required for equal developments, a comparison of achievements, as we now think of it, must take into consideration differences in maxima toward which the groups are growing. This idea implies that one boy, for example, who has a faster growth rate and requires a shorter time to reach maturity of a given cycle is not considered superior to another boy as long as his maximum achievement falls below the maximum achievement for the second boy who nevertheless has a slower growth rate and a longer maturation period.

There are no available techniques which may be employed in determining relationships between "quality" (growth rate), and "capacity" as

[21] *Note that in the preceding diagnosis of unmatched groups the two maxima were approximately equal.*

TABLE 4

DIFFERENCES IN READING PERFORMANCE OF H. F. S. BOYS AND GIRLS AT VARIOUS AGE LEVELS. MATCHED GROUPS[4]

| Ages | Score[1] | | | | Educational Ages[2] | | | | Isochronic Development[3] | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Girls | Boys | Diff. | Ratios (G ÷ B) | Girls | Boys | Diff. | Ratios (G ÷ B) | Girls | Boys | Diff. | Ratios (G ÷ B) |
| 7-6 | 5.85 | 4.32 | 1.52 | 1.35 | — | — | — | — | 20.75 | 19.45 | 1.30 | 1.06 |
| 8-0 | 21.30 | 17.85 | 3.45 | 1.13 | 90 | 85 | 5 | 1.05 | 27.90 | 26.31 | 1.59 | 1.06 |
| 8-6 | 40.04 | 36.68 | 3.36 | 1.09 | 111 | 107 | 4 | 1.03 | 35.05 | 33.17 | 1.88 | 1.05 |
| 9-0 | 54.46 | 52.64 | 1.82 | 1.03 | 123 | 121 | 2 | 1.01 | 42.20 | 40.04 | 2.16 | 1.05 |
| 9-6 | 63.32 | 63.12 | 0.20 | 1.00 | 131 | 131 | 0 | 1.00 | 49.35 | 46.90 | 2.45 | 1.05 |
| 10-0 | 68.15 | 69.19 | -1.04 | .99 | 136 | 137 | -1 | .99 | 56.51 | 53.77 | 2.74 | 1.05 |
| 10-6 | 70.64 | 72.46 | -1.82 | .97 | 138 | 140 | -2 | .98 | 63.56 | 60.63 | 2.93 | 1.04 |
| 11-0 | 71.96 | 74.13 | -2.17 | .97 | 139 | 142 | -3 | .97 | 70.81 | 67.49 | 3.32 | 1.04 |

1 - 2 - 3 - were computed as explained in Table 3

[4]I. Q.'s. . . . Boys, 106.1; Girls, 106.1; Ratio, 1.00

Constants in Equations

a. Rates of Growth . . . . . Boys - 1.144; Girls - 1.192; Ratio - (G ÷ B) = 1.04
b. Beginning of Growth . . . . Boys - 73.2 mos., Girls - 72.6 Diff. - (B - G) = 0.4 mo.
c. Time Required for Growth. . Boys - 69.1 mos., Girls - 65.9 Ratio - (B ÷ G) = 1.04
d. Age at Completion of Growth . . . . . Boys - 142.1 mos., Girls - 138.5 Diff. - (B - G) = 3.6 mos.
e. Maxima. . . . . Boys - 75.96; Girls - 73.21; Ratio - (G : B) = .96

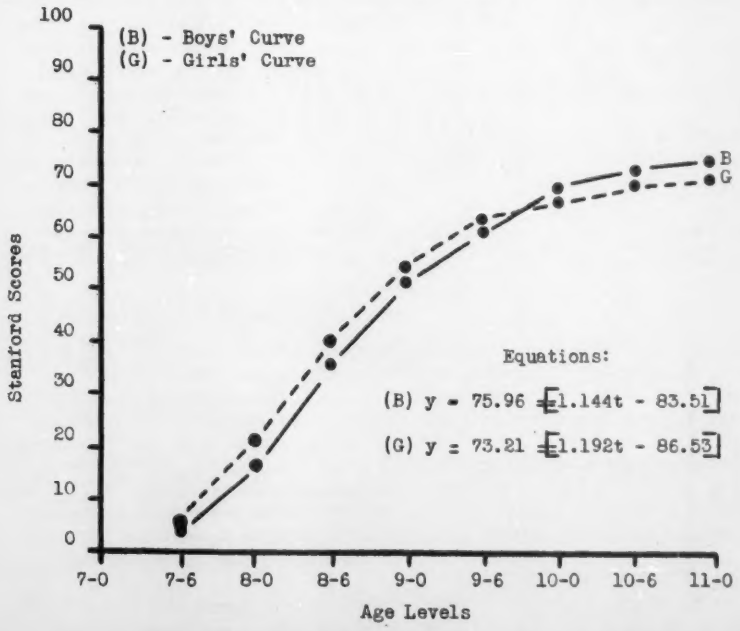



Fig. 7. Comparison of Reading Achievement of Boys and Girls of Equal I.Q.'s.

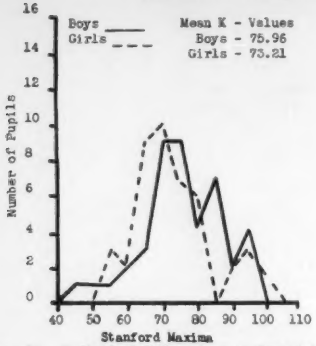



Fig. 8A. Individual Differences in Pre-Adolescent K-Reading Values. (Showing Distribution by Sex of Boys and Girls Unmatched According to I.Q.)

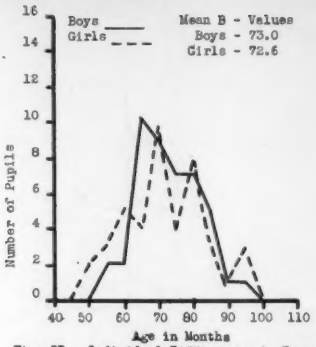



Fig. 8B. Individual Differences in Time at which Reading Growth Begins. (Showing Distribution by Sex of Boys and Girls Matched According to I.Q.)

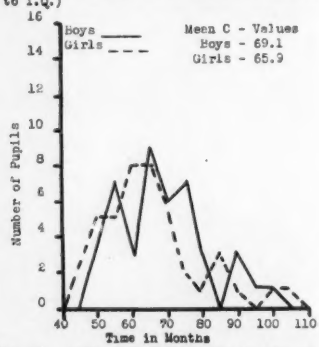



Fig. 8C. Individual Differences in Ages at which Complete Maturation (99.0) of the Pre-Adolescent Reading Curve Occurs. (Boys and Girls Matched According to I.Q.)

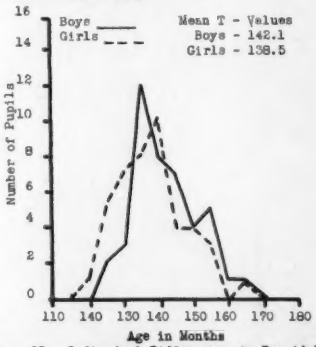



Fig. 8D. Individual Differences in Pre-Adolescent Rates of Growth in Reading. (Boys and Girls Matched According to I.Q.)

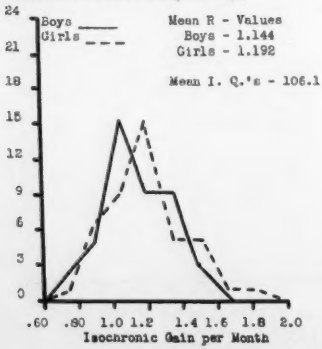



Fig. 8E. Individual Differences in Pre-Adolescent Rates of Growth in Reading. (Showing Distribution by Sex of Boys and Girls Matched According to I.Q.)

Fig. 8. Sex Differences in Pre-Adolescent Reading Constants. Mean I.Q.'s: 106.1 (Matched Boys and Girls).

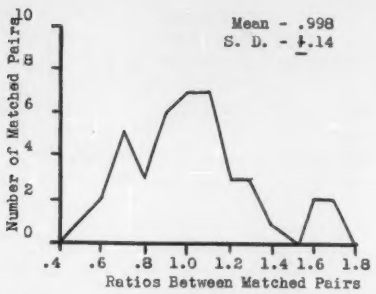



Figure 9. Distribution of Ratios Between Members of Matched Pairs after Equalizing Differences Due to Sex.

$$\frac{G}{B} = \frac{\text{Rate of Growth (G)}}{\text{Rate of Growth (B)}} \times \frac{\text{Maximum (G)}}{\text{Maximum (B)}}$$

expressed by the maximum. The only method of procedure available is that of formulating a tentative solution and testing by the facts forthcoming.

Proceeding on this basis the data are again approached. Whereas the girls show greater development at a given age (a greater maturity value at a given time), they are growing toward a lesser maximum (Table 4). Immediately a solution suggests itself in a multiplicative ratio between rates of growth and maxima. That is, $\frac{\text{Girls}}{\text{Boys}} = \frac{\text{Rate (G)}}{\text{Rate (B)}} \times \frac{\text{Max. (G)}}{\text{Max. (B)}}$.

Mathematically, from the equations (p. 88), $\frac{G}{B} = \frac{1.192}{1.144} \times \frac{73.21}{75.96} = .9984$;

or, expressed for each pair,

(a) Boys' Rate of Growth = Girls' Rate of Growth x $\frac{\text{MaxG}}{\text{MaxB}}$, or

(b) Girls' Rate of Growth = $\frac{\text{Boys' Rate of Growth}}{\frac{\text{Max.G}}{\text{Max.B}}}$

Utilizing the above equation, rates were equated for each of the forty-three pairs and the ensuing ratios graphed. The few pairs available (43) form a fairly good distribution around a 1 to 1 ratio (S. D. ± .14), but with wide individual variations.

Conclusion: Although there are characteristics of the reading achievement curve which can be attributed to the effect of sex, differences in rates of growth, differences in time at which maturity is reached, and differences in maxima, there is no basic difference in achievement when all of these factors are taken into consideration.[22]

[22] *The writer is fully aware of the possibility of an adolescent effect upon performance which has not been considered here. There is the possibility also that a sex characteristic has been ruled out by I.Q. matching.*

## THE EFFECT OF INTELLIGENCE UPON READING PERFORMANCE

Studies of the effect of intelligence upon reading performance are too numerous to mention. Let it be sufficient to state that in the conclusion that reading achievement correlates highly with measures of intelligence there is general agreement. The range of positive correlation lies somewhere between the +.489 found by Gates[23] and the +.720 reported by Reed.[24]

The purpose of this section is to note the effect of differences in intelligence upon reading development, as portrayed by individual growth curves in reading.

### Treatment of Data

Subjects: Since I.Q.'s were available for all cases it was possible to divide both boys and girls into two groups, one to be called the Upper Boys (or Girls) and the other to be called the Lower Boys (or Girls). Had a large number of cases been available, it would have been advisable to have made comparisons of the mean reading constants of groups of children at several intelligence levels. However, the comparatively small number of cases available rendered this scheme impractical. As a result the following groupings were made:

| Boys' Cases | | Girls' Cases | |
|---|---|---|---|
| High (105 Up) | Low (104 Down) | High (111 Up) | Low (110 Down) |
| 1m - 111 | 5m - 86 | 2f - 127 | 1f - 100 |
| 2m - 111 | 7m - 90 | 5f - 112 | 3f - 107 |
| 3m - 111 | 16m - 101 | 8f - 117 | 6f - 95 |
| 4m - 107 | 95m - 100 | 10f - 120 | 7f - 90 |
| 8m - 106 | 21m - 96 | 13f - 111 | 9f - 103 |
| 9m - 115 | 23m - 88 | 12f - 113 | 11f - 81 |
| 10m - 115 | 24m - 88 | 4f - 113 | 15f - 109 |
| 11m - 105 | 25m - 102 | 19f - 115 | 17f - 84 |
| 12m - 122 | 31m - 103 | 22f - 125 | 18f - 103 |
| 13m - 111 | 35m - 88 | 24f - 119 | 21f - 104 |
| 14m - 111 | 36m - 85 | 25f - 118 | 26f - 103 |
| 15m - 106 | 37m - 98 | 27f - 117 | 28f - 106 |
| 17m - 115 | 42m - 103 | 35f - 118 | 29f - 102 |
| 18m - 112 | 48m - 100 | 37f - 140 | 31f - 102 |
| 19m - 106 | 50m - 101 | 38f - 111 | 32f - 105 |
| 20m - 107 | 55m - 102 | 40f - 129 | 33f - 89 |
| 22m - 109 | 60m - 97 | 45f - 128 | 34f - 96 |
| 26m - 106 | 61m - 100 | 50f - 117 | 41f - 108 |
| 27m - 106 | 63m - 102 | 53f - 116 | 42f - 91 |
| 28m - 119 | 65m - 86 | 55f - 123 | 43f - 102 |
| 30m - 107 | 70m - 103 | 62f - 114 | 48f - 94 |
| 34m - 106 | 71m - 104 | 63f - 144 | 49f - 109 |
| 40m - 114 | 77m - 103 | 74f - 114 | 51f - 93 |

[23] *Gates, A. I., Psychology for students of education. New York: The Macmillan Company, 1925, pp. 441-443.*

[24] *Reed, H. B., Psychology of elementary school subjects. New York: Ginn and Co., 1927, pp. 68-69.*

| Boys' Cases | | Girls' Cases | |
|---|---|---|---|
| High (105 Up) | Low (104 Down) | High (111 Up) | Low (110 Down) |
| 41m - 114 | 80m - 101 | 76f - 115 | 52f - 105 |
| 44m - 110 | - - - - - | 77f - 114 | 58f - 95 |
| 45m - 105 | - - - - - | 81f - 131 | 59f - 107 |
| 46m - 112 | - - - - - | 84f - 115 | 64f - 103 |
| 49m - 124 | - - - - - | - - - - - | 65f - 107 |
| 51m - 114 | - - - - - | - - - - - | 68f - 108 |
| 52m - 111 | - - - - - | - - - - - | 69f - 110 |
| 72m - 112 | - - - - - | - - - - - | 70f - 109 |
| - - - - - | - - - - - | - - - - - | 71f - 106 |
| - - - - - | - - - - - | - - - - - | 78f - 104 |
| - - - - - | - - - - - | - - - - - | 80f - 100 |
| - - - - - | - - - - - | - - - - - | 82f - 109 |
| - - - - - | - - - - - | - - - - - | 83f - 97 |
| Mean I.Q. | Mean I.Q. | Mean I.Q. | Mean I.Q. |
| 111.0 | 97.0 | 119.8 | 101.0 |

Curves of Constants were then determined for the four groups of pupils, and scores were computed at various age levels from the equations (Tables 5 and 6).

## Results

For both boys and girls the computed achievements of the Upper Groups are markedly superior to those of the Lower Groups (Tables 5 and 6, Figures 10 and 11).

Scores, educational ages, and isochronic developments all testify to

TABLE 5

DIFFERENCES IN READING PERFORMANCE AT VARIOUS AGE LEVELS OF BOYS' GROUPS DIFFERING IN MEAN INTELLIGENCE[4]

| Age | Score[1] | | | | Educational Ages[2] | | | | Isochronic Development[3] | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Upper | Lower | Diff. | Ratios (U ÷ L) | Upper | Lower | Diff. | Ratios (U ÷ L) | Upper | Lower | Diff. | Ratios (U ÷ L) |
| 7-6 | 9.5 | .4 | 9.1 | 23.75 | ___ | ___ | ___ | ___ | 22.96 | 13.86 | 9.10 | 1.65 |
| 8-0 | 28.5 | 5.1 | 23.4 | 5.58 | 99 | ___ | ___ | ___ | 29.74 | 20.56 | 9.18 | 1.44 |
| 8-6 | 47.3 | 18.2 | 29.1 | 2.59 | 117 | 86 | 31 | 1.36 | 36.53 | 27.26 | 9.27 | 1.34 |
| 9-0 | 61.2 | 34.7 | 26.5 | 1.75 | 129 | 106 | 23 | 1.21 | 43.31 | 33.96 | 9.35 | 1.27 |
| 9-6 | 69.7 | 48.3 | 21.4 | 1.44 | 138 | 118 | 20 | 1.17 | 50.10 | 40.66 | 9.44 | 1.23 |
| 10-0 | 74.4 | 57.1 | 17.3 | 1.30 | 142 | 126 | 16 | 1.12 | 56.89 | 47.36 | 9.53 | 1.20 |
| 10-6 | 76.9 | 62.3 | 14.6 | 1.23 | 146 | 130 | 16 | 1.12 | 63.67 | 54.07 | 9.60 | 1.17 |
| 11-0 | 78.2 | 65.1 | 13.0 | 1.19 | 147 | 133 | 14 | 1.10 | 70.46 | 60.77 | 9.69 | 1.15 |

[1]Scores Computed from Equations of Curves of Constants. [2]Educational Ages found by referring computed scores to Stanford Norms. [3]Isochronic Development determined from Equations of Curves of Constants. [4]Mean I. Q.'s, Upper Boys, 111.0; Lower Boys, 97.0; Ratio, (U ÷ L) = 1.14

Constants in Equations

a. Rates of Growth . . . . . Upper Boys - 1.131; Lower Boys - 1.117; Ratio (U ÷ L) = 1.01
b. Beginning of Growth. . . . Upper Boys - 69.7 mos. " " - 77.6 mos. " (L ÷ U) = 1.11
c. Time Required for Growth . " " - 70.3 mos. " " - 70.0 mos. " (U ÷ L) = 1.00
d. Age at Completion of Growth . . . . . " " -139.6 mos. " " -147.6 mos. " (L ÷ U) = 1.06
e. Maxima . . . . . " " - 79.7; " " - 68.2; " (U:L) - 1.17

TABLE 6

DIFFERENCES IN READING PERFORMANCE AT VARIOUS AGE LEVELS OF GIRLS' GROUPS DIFFERING IN MEAN INTELLIGENCE[4]

| Ages | Score[1] | | | | Educational Ages[2] | | | | Isochronic Development[3] | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Upper | Lower | Diff. | Ratios (U ÷ L) | Upper | Lower | Diff. | Ratios (U ÷ L) | Upper | Lower | Diff. | Ratios (U ÷ L) |
| 7-6 | 22.5 | 2.2 | 20.3 | 10.22 | 92 | | | | 27.27 | 17.76 | 9.51 | 1.53 |
| 8-0 | 44.6 | 13.1 | 31.5 | 3.40 | 115 | 78 | 37 | 1.47 | 34.63 | 24.96 | 9.67 | 1.38 |
| 8-6 | 62.0 | 31.0 | 31.0 | 2.00 | 130 | 102 | 28 | 1.27 | 42.00 | 32.16 | 9.84 | 1.30 |
| 9-0 | 72.5 | 46.5 | 26.0 | 1.55 | 140 | 116 | 24 | 1.20 | 49.37 | 39.36 | 10.01 | 1.25 |
| 9-6 | 78.1 | 56.9 | 21.2 | 1.37 | 147 | 126 | 21 | 1.16 | 56.74 | 46.56 | 10.18 | 1.21 |
| 10-0 | 81.1 | 62.8 | 18.3 | 1.29 | 151 | 130 | 21 | 1.16 | 64.11 | 53.76 | 10.35 | 1.19 |
| 10-6 | 82.4 | 65.8 | 16.6 | 1.25 | 152 | 134 | 18 | 1.13 | 71.47 | 60.96 | 10.51 | 1.17 |
| 11-0 | 83.1 | 67.4 | 15.7 | 1.22 | 154 | 135 | 19 | 1.14 | 78.84 | 68.16 | 10.68 | 1.15 |

[1]Scores computed from equations of Curves of Constants. [2]Educational Ages found by referring computed scores to the Stanford Norms. [3]Isochronic Development determined from Equations of Curves of Constants. [4]Mean I. Q.'s, Upper Girls, 119.8; Lower Girls, 101.0; Ratio, (U ÷ L) = 1.18

Constants in Equations

| | | | |
|---|---|---|---|
| a. Rates of Growth. . . . . | Upper Girls - 1.228; | Lower Girls - 1.200; | Ratio (U ÷ L) = 1.02 |
| b. Beginning of Growth. . . . | " " -67.8 mos. | " " - 75.2 mos. | " (L ÷ U) = 1.10 |
| c. Time Required for Growth . | " " -64.4 mos. | " " - 65.4 mos. | " (L ÷ U) = 1.01 |
| d. Age at Completion of Growth | " " -132.3 mos. | " " - 140.6 mos. | " (L ÷ U) = 1.06 |
| e. Maxima . . . . . | " " -83.8; | " " - 69.0; | " (U ÷ L) = 1.21 |

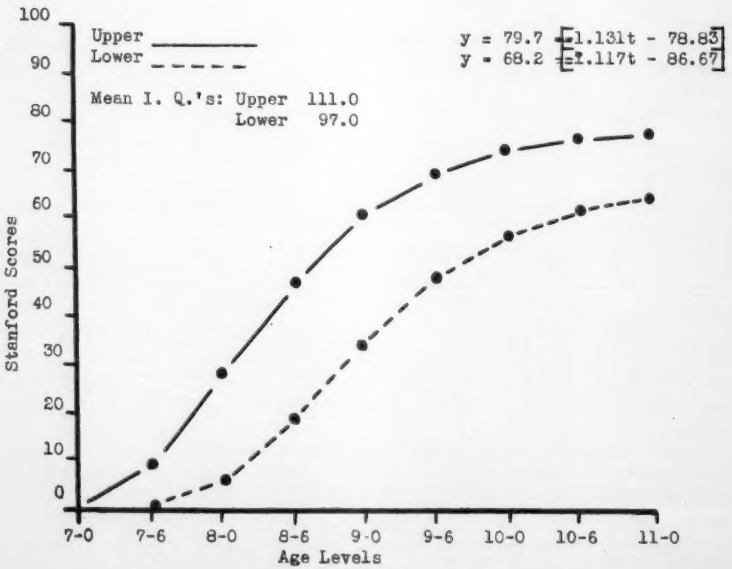



Fig. 10. Comparison of Reading Performances of Two Groups of Boys at Different I.Q. Levels.

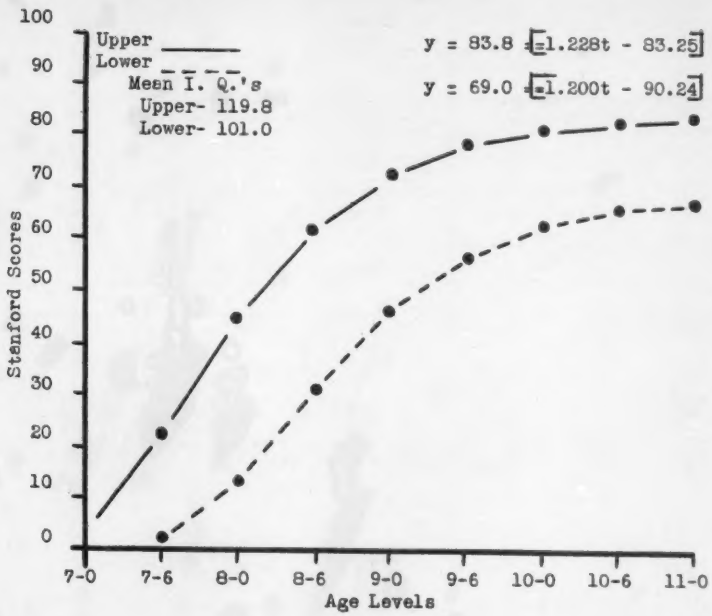



Fig. 11. Comparison of Reading Performances of Two Groups of Girls at Different I.Q. Levels.

the influence of intelligence as a factor in reading performance. Variability in the ratios obtained between performances of the two intelligence levels suggests widely different characteristics of growth (Tables 5 and 6).

The more intelligent children, both boys and girls, are growing toward higher maxima, and begin and end their reading developments at earlier ages than the lower groups. On the other hand, rates of growth are nearly equal and the times required for developments are approximately the same (Tables 5 and 6).

The only ratio which approximates the ratio between the I.Q.'s of the Upper and Lower Groupings is that found between maxima. In each of the two comparisons, these ratios are but slightly larger than the I.Q. ratios.

Utilizing the correlation method, the relationships suggested by the ratios between constants of the comparable groups were verified (Table 7). Very high positive correlations (.73) were found to exist between the maximum toward which the child is growing and his intelligence quotient. Significant negative correlations, from .41 to .59, were likewise found to exist between the child's intelligence level and the ages at which he

TABLE 7

COEFFICIENTS OF CORRELATION BETWEEN I.Q.'s AND ELEMENTS OF GROWTH IN READING ACHIEVEMENT AS MEASURED BY STANFORD SCORES

| Elements of Growth | Boys' I. Q.'s | Girls' I. Q.'s |
|---|---|---|
| $^1R$ | + .12 | + .05 |
| $^2b$ | - .41 | - .51 |
| $^3c$ | - .0001 | - .0210 |
| $^4T$ | - .45 | - .59 |
| $^5K$ | + .731 | + .737 |

$^1R$ - Isochronic Rate of Growth

$^2b$ - Age at which Growth Begins

$^3c$ - Number of Months Required for Complete Maturation (99.0%)

$^4T$ - Age at which Growth is completed

$^5K$ - Maximum Score Toward which Growth is Progressing

begins and completes his reading cycle. Lines of regression are shown in Figures 12 and 13.

Prediction of Intelligence from Reading Scores: The foregoing pages have demonstrated the existence of certain relationships between reading performance, as measured by the Stanford tests, and intelligence measures. The question may now be asked, "To what extent is it possible to determine individual intelligence indices from a knowledge of a child's growth in reading achievement?" Since such high correlations were found to exist between the reading maxima and the respective I.Q. levels, the question may be repeated even more specifically, "To what extent can individual intelligence indices, comparable to the I.Q., be determined from individual maxima?" Utilizing the equation

$$\frac{I.Q.^*}{I.Q.} = \frac{K^*}{K}$$

which implies the "brighter" the child the higher his reading maximum,

*Developmental Ratio was determined from the equation, D. R. = $\frac{\text{Time Required by Individual for Complete Maturation } (T_1)}{\text{Time Required for Group for Complete Maturation } (T)}$

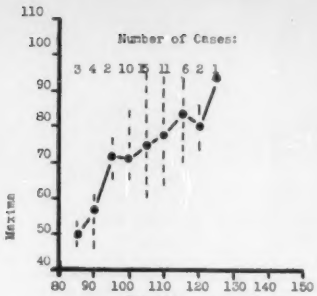



Figure A. Relationship Between I. Q.'s and Boys' Median Maxima

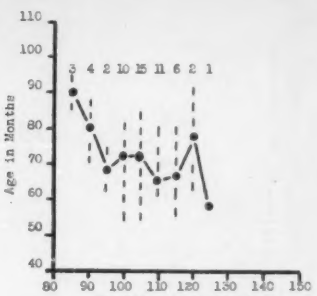



Figure B. Relationship Between I. Q.'s and Boys' Median Age at which Reading Achievement Begins

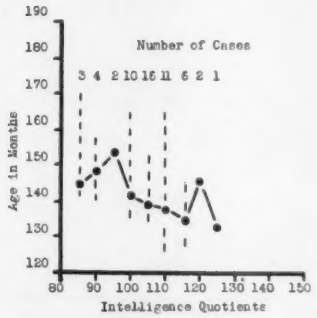



Figure C. Relationship Between I. Q.'s and Boy's Median Age at which Reading Achievement Reaches Maturity

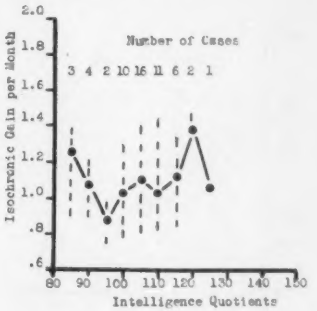



Figure D. Relationship Between I. Q.'s and Boy's Median Rates of Growth in Reading

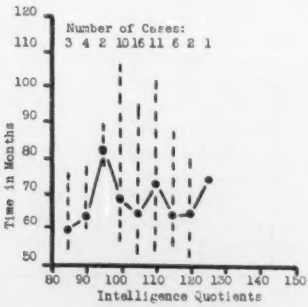



Figure E. Relationship Between I. Q.'s and Boy's Median Time Required for Complete Maturation.

**Fig. 12. Relationship Between I.Q.'s and Computed Constants in the Reading Equation (Boys).**

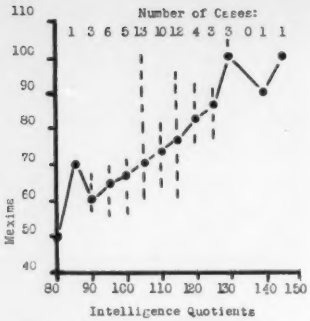



Figure A. Relationship Between I. Q.'s and Girl's Median Maxima

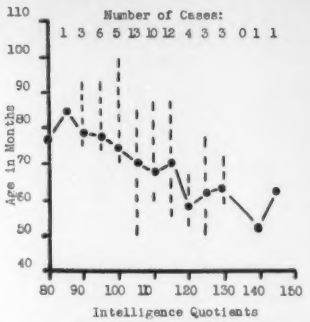



Figure B. Relationship Between I. Q.'s and Girl's Median Age at which Reading Achievement Begins

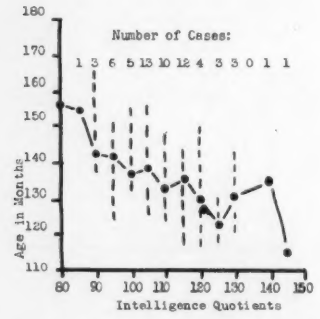



Figure C. Relationship Between I. Q.'s and Girl's Median Age at which Reading Achievement Reaches Maturity

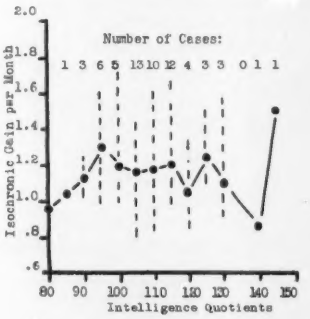



Figure D. Relationship Between I. Q.'s and Girl's Median Rates of Growth in Reading

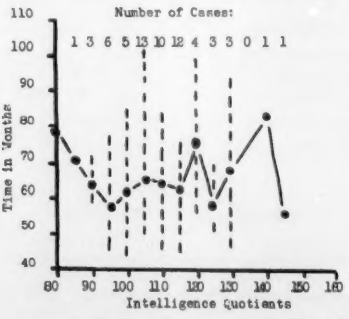
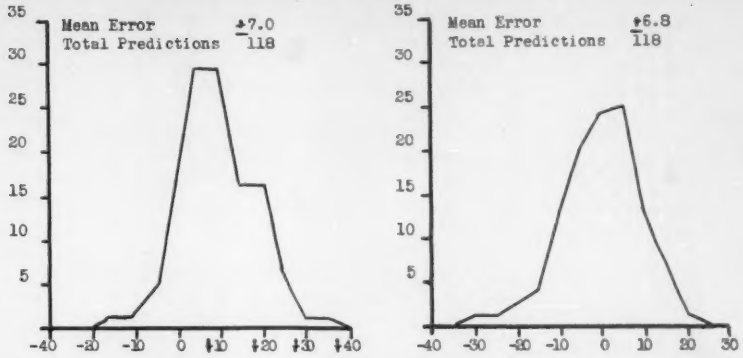



Figure E. Relationship Between I. Q.'s and Girl's Median Time Required for Complete Maturation

Fig. 13. Relationship Between I.Q.'s and Computed Constants in the Reading Equation (Girls).




A. Distribution of Errors in Predicting Individual Intelligence Ratios from the Equation, Reading I. Q. = $\frac{K^1}{K}$ x I. Q.

B. Distribution of Errors in Predicting Individual Intelligence Ratios from the Equation, Reading I. Q. = $\frac{K^1}{K}$ x D. R.

Fig. 14. Distribution of Error in Predicting Individual Intelligence Ratios from Individual Reading Ratios.

an average error or ± 7.0 was found in predicting individual I.Q.'s for all cases (Figure 14A).

Using the developmental ratio of each child corrected for his maximum,

$$\text{Reading I.Q.} = \text{D.R.}^{*} \times \frac{\text{Individual Max.}}{\text{Group Max.}}$$

a ratio, comparable to the I.Q., was determined for each individual which showed a mean deviation of ± 6.8 from the actual I.Q.'s (Figure 14B).

Conclusion: Intelligence was found to be a potent factor not only in determining performance at a given time, but likewise in determining the very character of learning. The bright children were found to begin achievement at an earlier age than the dull children, and consequently to mature earlier. Although intelligence seemed to have no effect upon rate of growth in reading, differences were found to exist in the maxima to be achieved.

## APPRAISAL AND IMPLICATIONS

### Evaluation of the Growth Technique

In every phase of the study the growth technique proved to be practical and efficient in describing growth in reading achievement. Its value was also demonstrated in analyzing differences in various aspects of growth of comparable groups of children.

*Developmental Ratio was determined from the equation, D. R. = Time Required by Individual for Complete Maturation ($T_1$) / Time Required for Group for Complete Maturation ($T$)*

In view of present limitations in our concept of growth, the foremost value in the technique lies in its use as an instrument of analysis. Only when sufficient knowledge is derived concerning all phases of growth can the technique realize its maximum potentialities as an instrument of prediction.

One of the greatest criticisms of educational research lies in the fact that results from one section of the country cannot be verified by results from another section. It is the belief of the writer that much of the existing inconsistency will disappear when data are collected and arrayed in terms of growth.

## Nature of the Reading Achievement Curve

To the uninitiated the wide variation between the "curves of Constants" and the curve of the Stanford norms (Figure 4) will cause great surprise if not downright consternation. Only by a stretch of the imagination can the line drawn between the Stanford grade norms be called a curve, whereas there is no doubt as to curvilinear character of the "Curve of Constants." The explanation has already been given that the straight-line effect is due to smoothing which involuntarily occurs when the scores of a large number of children are averaged who possess, as is shown in this study, individual characteristics.

A study of the distribution of errors of the predicted scores from the observed scores is enlightening (Figure 3). Were any reader to remain skeptical regarding the curvilinear nature of reading growth, an analysis of the error distribution will prove helpful. The errors are fairly well divided as positive and negative errors. This means that the curves formed by the predicted scores, which form perfect curves, do not all fall above observed performances, thereby producing a majority of positive errors, which would be the case if individual growth followed more nearly a linear than a curvilinear form of development.

## Effect of Teaching

It is a well-known fact that reading activities form the base of the curricular program in the first two grades. When a child reaches grades three and four, many other subjects are introduced and the emphasis given to reading activities in the first two grades is considerably lessened. In grades five and six, reading activities utilize even less time, although the pupils employ their knowledge of reading in practically every subject. The point to be made is that in spite of the shift in method used in teaching reading, the curve of achievement follows, from grade to grade, a precise pattern of development. Nor does the achievement curve appear to be significantly affected by the change in teachers which occurs as the child progresses from grade to grade. Case 52M, Figure 15, illustrates this fact. In the instance of this child the obtained test scores show less than $\pm$ 2.0 deviation in the child's developmental curve over a period of forty-four months.

Case 50M, Figure 15, illustrates the dismay and consternation brought to the teacher who interprets achievement from one testing to another in terms of the Stanford norm. According to the norms, marvelous improve-

ment is shown between the first two testings. The curve rises sharply, almost perpendicularly. In terms of the norm, the third testing, following an interval of normal teaching activity, shows improvement scarcely up to the amount expected for the time intervening. The teacher becomes upset and feels generally that her efforts have been woefully ineffective. Looking at the curve from the point of view of growth, the interpretation is that the growth made between the second and third testing is equal, per unit of time, to the growth made between the first two testings.

## Implications to Educational Diagnosis

From the practical point of view no one can overlook the great contributions which tests and measurements have made to education in general and to the teaching of reading in particular. Everyone interested in educational research is familiar with these, but in order to point out the need for improvements in our diagnostic techniques a review of certain outstanding contributions is pertinent.

Only through educational tests have the existence and importance of individual differences in the capacities of children been made known. Before tests were available, individual interests were ignored, and individual needs were unknown concepts. Subject matter was broken into grade levels, and children were required to read, write, spell, and do arithmetic at a given time, without any consideration being given as to whether words or numbers had any meaning. Educational requirements were entirely standardized, and children consequently mastered essentials in

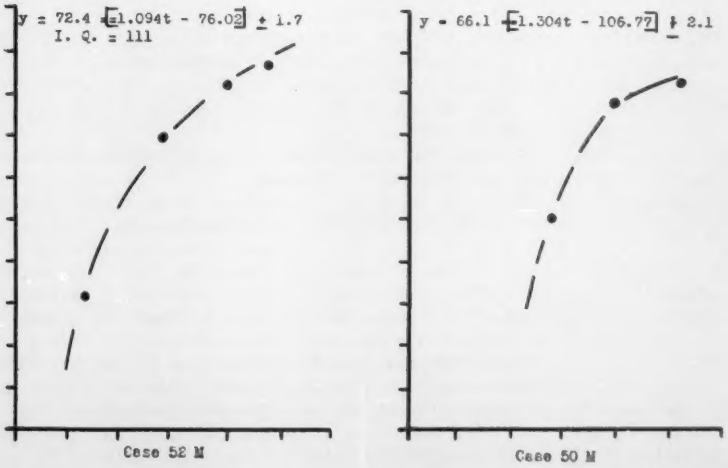



Fig. 15. Cases Illustrating the Regularity of the Growth Pattern Over Extended Age Intervals.

varying degrees of success. When the percentage of mastery achieved by a given child failed to reach a high enough plane, the child was held back and the same dose was repeated.

Educational tests have revealed differences in the children's patterns of development. Teachers have been lead to define their aims more carefully, and to appraise success objectively. Much experimental work has been stimulated which has improved our knowledge of the nature of reading and the best teaching procedures to employ.

The acquisition of skills in reading has become a less painful procedure because of the development of individual techniques in teaching. The amount of time required for practice and for repetition in learning a specific skill has been adapted to individual needs. Special helps and clinical aids are brought into use with those who travel too slowly. Consequently, with the informed teacher, the slower child has been released from the pressure which inevitably threatened his course and undermined his sense of security. These achievements characterize the advance which tests have brought into our educational thinking.

Through ignorance and misuse there is also a dark side to the picture. Many administrators and teachers use tests as instruments for revealing absolute and final truths, when in reality tests are still very imperfect instruments for measuring children's reactions. Likewise, because reading tests have such widespread application, many persons feel that our understanding of reading is approaching its maximum. As a matter of fact, real control in the field of reading has yet to begin.

Differences in the individual reading curves portrayed in this study indicate that educational testing which has done much to show the need for individual teaching techniques must soon put its own house in order. A comparison of the reading development of an individual child with a so-called norm points out the injustice done the child. This study reveals the fact that the only proper basis on which to judge an individual's performance in reading is by comparison with his own growth curve. Consecutive measures furnish the data for comparison. Under the conditions governing his growth as long as actual growth agrees with predicted growth the child is growing normally. When departures are made from the course of predicted growth, the investigator may know that some new influence is active, and consequently may evaluate its effect.

## Implications for Curriculum Development

A knowledge of the reading achievement curve and of the technique in evaluating effects probably offers greater opportunities to the curriculum makers than to any other group. Consecutive measures of achievement make it possible to compare the effectiveness of a new program upon achievement through both individual and group analysis. For example, it will be a future possibility to compare the pattern of the development in reading already established with a future pattern produced perhaps under a changed curriculum. A long time program indeed, but one surely more significant and of more import than a thousand of the conventional three-month testing surveys which make comparisons of the averages of large groups with the average of even larger groups.

The implications of this study are many and varied. In the first

place, a study of the individual curves illustrate the fact that children are capable, under constant conditions, of reaching only one natural maximum. Excessive teaching effects can bring only superficial results. The child must live at his own natural age-social level. The well-informed teacher realizes that to stimulate him above this level brings only an unnatural condition. Arriving at a given reading maturity ahead of his interest maturity may make a child outstanding in his skill mechanics, but it will require him to read at a level of interest beyond his natural development, if he is going to utilize his mechanics to the utmost. If he does not exercise his skill at this level, his skill deteriorates. This condition is often found in those schools where a major emphasis is placed upon reading mechanics in the lower elementary grades.

By introducing reading more gradually and at the times when the child realizes a real need or feels the desire to read, the reading curve will naturally follow the child's maturity curve and the status of his achievement at any time will be compatible with his interest and social maturity. Therefore, no excuse need be made for the later introduction of formal reading.

The teacher, informed as to the nature of the reading achievement curve, does not become alarmed because certain pupils progress at slower rates. Pressure is something that should no longer be utilized in enabling teachers to drive pupils toward an unnaturally high standard. With a knowledge of differences of the learning curves of individual children, the teacher may know that a pupil who appears slow at an early grade level may simply be showing the result of a late starting point. It is not unusual to find pupils who, in spite of pressure and assistance on the part of the teacher, have shown scarcely any indication of reading ability up to the end of the second grade. In some instances, without any apparent outside influence, these same pupils begin to read and at the upper elementary grade levels frequently outstrip others who began earlier but progressed at a slower rate of learning. The uninformed teacher is often amazed that children, known to be intelligent, show no permanent benefits from lengthy drill and remedial periods. These teachers have not yet learned that the real growth curve of the individual is but little effected by instruction for which the child is not ready.

There are certain aspects of individual differences which need further investigation. Teachers are too likely to think of individual differences as differences in what is commonly called capacity. As a result of this concept, children are frequently given intelligence tests to determine whether they are yet ready for the introduction of formal reading. Definite mental maturities have been determined as the proper age for the acquisition of certain specific skills. But as the existence of individual differences has been recognized, so must there be a full application of this idea. A norm is only a mythical concept, - a theoretical point of view. Mental ages are determined by comparing an individual child with the average of "all" children. By this relationship, we attempt to adjust achievement. We have not yet been brought to the realization that individual differences are much more complex than this. A number of children in any first grade may arrive at a given time to a mental age of six years. This is well and good, and for the time being we may conclude that these children are mature enough to begin reading. But a mental age of six years does not necessarily indicate equal poten-

tialities. This, however, is the conventional viewpoint. Cumulative studies show that a child among others with a mental age of six years in the first grade may deviate above or below in the second grade, or he may continue along with the others. Therefore, the primary teacher must not conclude that a group will progress at equal rates because the group have, at a given time, reached a mental age of six years.

In the upper elementary grades, a teacher may be disappointed in the progress of a child, as measured by given standard tests. To her dismay, she may find that in the preceding year marked improvement was made. Undoubtedly a graph of the child's reading achievement would indicate natural progress throughout, and the exceptional rise would be found to occur on the early part of the curve. In these upper grades, then, children should not be driven or given excessive drill because they appear to be approaching a standstill. The teacher should study the progress of the child throughout all grades. The evidence of a standstill may be found to be faulty when the scores are treated in terms of growth, and progress may be found to be perfectly normal when so considered.

## SUMMARY

The investigation undertaken to determine the character of the preadolescent curve in reading achievement resulted in the following conclusions:

1. Regularity of Growth: The equations derived from the observed performances were found to picture the reading development of the entire group within a mean deviation of less than $\pm$ 3.0 points from actual measured performances. Approximately one-third of the errors were found to deviate less than $\pm$ 1.0 from observed measures. In view of the conditions which tend to produce unreliable test results, such as unreliability in the test itself, the varying effects of teaching as the child progresses from grade to grade, variation in health, etc., it seems remarkable that individual performances follow such a predictable pattern of development.

2. Sex Differences in Growth: Utilizing the Curves of Constants of unmatched boys and girls, girls' performances were found to be superior to those of boys. Significant differences in the growth patterns favoring girls were found to exist in the ages at which the groups began and completed their cycles of development.

When allowances were made for differences in intelligence, no significant differences were found to exist between boys' and girls' scores.

3. Effect of Intelligence: For both boys and girls, the reading achievements of the groups with the higher I.Q.'s were found to be markedly superior to those of the groups with lower I.Q.'s.

The more intelligent children, both boys and girls, were found to be growing toward higher maxima, and likewise began and ended the preadolescent reading cycle at earlier ages than the children of lower intelligence levels.

Intelligence ratings were predicted from individual reading ratios, which varied less than $\pm$ 7.0 from the measured I.Q.[25]

[25] *This amount of variation is equivalent to the deviation found between I.Q. measures for these children.*

4. Comparison of Individual Performance with Stanford Norms: In all instances, wide differences were found to occur between an individual pattern of growth and growth as represented by the Stanford norms. The Curves of Constants (Figure 4) and the individual curves illustrate the fact that growth in reading presents certain curvilinear characteristics which are not comparable with the approximate straight-line norms of the Stanford tests.

The conclusion must be made that the concept of norms needs revision. Evidence such as that shown in this study illustrates the injustice done many children by comparing their performances with so-called norms which so inadequately describe the true nature of growth.

# APPENDIX A

## Boys' Stanford Scores

## in

## Reading

## Pre-Adolescent Constants

General Isochronic Equation

$$y = K_1 = [= r_1 t + i_1]$$

Equation from Mean Values

$$y = 74.7 = [= 1.123t - 82.20]$$

"b", point taken as beginning of growth

"c", approximate time required for completion of cycle

"t", age at which approximate completion of development occurs

## APPENDIX A

## BOYS' READING SCORES

## PRE-ADOLESCENT CONSTANTS

| Case No. | I.Q. | $k_1$ | $r_1$ | $b_1$ | $c_1$ | $t_1$ | Dev. | Age Span | Scores |
|---|---|---|---|---|---|---|---|---|---|
| 1m | 111 | 67.6 | 1.064 | 64.5 | 71.5 | 136.0 | ±2.4 | 88-116 | 6 |
| 2m | 111 | 79.4 | 1.207 | 69.4 | 63.0 | 132.4 | ±1.9 | 94-122 | 6 |
| 3m | 111 | 95.5 | .745 | 63.6 | 101.9 | 165.5 | ±2.8 | 106-134 | 6 |
| 4m | 107 | 85.1 | .868 | 69.7 | 87.4 | 136.5 | ±6.3 | 99-127 | 6 |
| 5m | 86 | 51.3 | 1.371 | 90.7 | 55.4 | 146.1 | ±1.7 | 110-134 | 5 |
| 7m | 90 | 57.5 | .981 | 70.7 | 77.3 | 148.0 | ±4.8 | 100-128 | 6 |
| 8m | 106 | 69.2 | 1.382 | 81.2 | 54.9 | 136.1 | ±3.2 | 105-133 | 6 |
| 9m | 115 | 72.4 | 1.254 | 66.4 | 60.6 | 127.0 | ±2.2 | 93-121 | 6 |
| 10m | 115 | 95.5 | .844 | 56.0 | 90.0 | 146.0 | ±2.6 | 95-123 | 6 |
| 11m | 105 | 74.1 | 1.198 | 74.0 | 63.5 | 137.5 | ±5.7 | 100-128 | 6 |
| 12m | 122 | 75.9 | 1.391 | 64.3 | 80.9 | 145.2 | ±2.2 | 93-122 | 6 |
| 13m | 111 | 63.1 | 1.485 | 74.1 | 51.2 | 125.3 | ±3.2 | 89-117 | 6 |
| 14m | 111 | 72.4 | 1.413 | 81.8 | 53.8 | 135.6 | ±3.2 | 106-122 | 4 |
| 15m | 106 | 60.3 | 1.170 | 68.2 | 65.0 | 133.2 | ±3.6 | 92-120 | 6 |
| 16m | 101 | 72.4 | .982 | 60.0 | 77.3 | 137.3 | ±5.3 | 94-118 | 5 |
| 17m | 115 | 75.9 | 1.148 | 70.0 | 66.1 | 136.1 | ±3.1 | 96-124 | 6 |
| 18m | 112 | 89.1 | 1.066 | 66.8 | 71.1 | 137.9 | ±4.6 | 99-135 | 7 |
| 19m | 106 | 75.9 | .775 | 55.6 | 97.9 | 153.5 | ±4.4 | 98-134 | 7 |
| 20m | 107 | 75.9 | 1.134 | 75.0 | 67.1 | 142.1 | ±2.1 | 104-128 | 5 |
| 95m | 100 | 70.8 | 1.032 | 66.6 | 73.8 | 140.4 | ±3.8 | 100-124 | 4 |
| 21m | 96 | 69.2 | .970 | 75.2 | 78.4 | 153.6 | ±2.6 | 107-143 | 7 |
| 22m | 109 | 79.4 | 1.021 | 64.0 | 74.3 | 138.3 | ±3.7 | 89-183 | 5 |
| 23m | 88 | 46.8 | 1.124 | 74.2 | 67.4 | 141.6 | ±3.9 | 101-133 | 6 |
| 24m | 88 | 57.5 | 1.227 | 88.8 | 61.8 | 150.6 | ±2.8 | 119-139 | 4 |
| 25m | 102 | 66.1 | 1.191 | 77.3 | 63.8 | 141.1 | ±2.1 | 107-135 | 6 |
| 26m | 106 | 75.9 | .928 | 68.8 | 81.7 | 150.5 | ±0.8 | 110-142 | 6 |
| 27m | 106 | 85.1 | 1.383 | 86.0 | 55.1 | 141.1 | ±2.6 | 114-130 | 4 |
| 28m | 119 | 85.1 | 1.464 | 93.5 | 52.0 | 145.5 | ±2.6 | 121-137 | 4 |
| 30m | 107 | 83.2 | .962 | 61.2 | 79.0 | 140.2 | ±2.8 | 106-130 | 5 |
| 31m | 103 | 67.6 | 1.122 | 82.0 | 67.9 | 149.9 | ±2.7 | 107-125 | 3 |
| 34m | 106 | 81.3 | 1.132 | 71.1 | 67.0 | 138.1 | ±2.8 | 105-133 | 6 |
| 35m | 88 | 58.9 | 1.111 | 85.3 | 74.2 | 159.5 | ±1.7 | 115-139 | 5 |
| 36m | 85 | 49.0 | 1.251 | 84.8 | 60.7 | 145.5 | ±1.2 | 115-135 | 4 |
| 37m | 98 | 69.2 | 1.063 | 81.5 | 71.5 | 153.0 | ±3.9 | 109-129 | 4 |
| 40m | 114 | 85.1 | 1.176 | 71.0 | 64.2 | 135.2 | ±1.5 | 97-129 | 4 |
| 41m | 114 | 89.1 | 1.097 | 65.8 | 69.2 | 135.0 | ±1.8 | 93-129 | 5 |
| 42m | 103 | 95.5 | 1.140 | 80.0 | 66.5 | 146.5 | ±2.9 | 104-128 | 4 |
| 44m | 110 | 87.1 | .854 | 64.6 | 88.9 | 153.5 | ±2.9 | 101-137 | 5 |
| 45m | 105 | 70.8 | 1.349 | 74.2 | 56.3 | 130.5 | ±1.3 | 99-123 | 3 |
| 46m | 112 | 85.1 | 1.038 | 68.0 | 73.1 | 141.1 | ±2.6 | 110-134 | 4 |
| 48m | 100 | 74.1 | 1.098 | 76.0 | 69.2 | 145.2 | ±3.8 | 100-136 | 5 |
| 49m | 124 | 95.5 | 1.040 | 58.2 | 73.1 | 131.3 | ±4.3 | 95-119 | 4 |
| 50m | 101 | 66.1 | 1.304 | 81.9 | 59.1 | 140.0 | ±2.1 | 107-131 | 3 |
| 51m | 114 | 83.2 | 1.390 | 81.4 | 54.7 | 136.1 | ±1.9 | 104-136 | 4 |
| 52m | 111 | 72.4 | 1.094 | 69.6 | 69.5 | 139.1 | ±1.7 | 94-126 | 4 |
| 55m | 102 | 72.4 | .701 | 56.0 | 108.5 | 164.5 | ±3.0 | 97-133 | 5 |
| 60m | 97 | 77.6 | .873 | 64.7 | 88.9 | 153.6 | ±2.3 | 106-142 | 5 |
| 61m | 100 | 85.1 | 1.331 | 81.3 | 57.1 | 138.4 | ±2.6 | 109-133 | 3 |
| 63m | 102 | 72.4 | 1.066 | 71.7 | 71.2 | 142.9 | ±2.5 | 105-139 | 3 |
| 65m | 86 | 50.1 | .989 | 94.0 | 76.6 | 170.6 | ±2.7 | 126-148 | 3 |
| 70m | 103 | 81.3 | 1.464 | 83.6 | 52.9 | 136.5 | ±0.7 | 112-136 | 3 |
| 71m | 104 | 74.1 | 1.334 | 87.6 | 56.9 | 144.5 | ±3.0 | 112-136 | 3 |
| 72m | 112 | 87.1 | 1.003 | 65.4 | 76.1 | 141.5 | ±4.2 | 97-133 | 5 |
| 77m | 103 | 75.9 | .996 | 76.0 | 76.3 | 152.3 | ±2.3 | 121-137 | 3 |
| 80m | 101 | 77.6 | 1.103 | 73.2 | 69.0 | 142.2 | ±3.1 | 109-125 | 3 |
| Mean | 104.8 | 74.7 | 1.123 | 73.2 | 70.2 | 143.0 | ±2.8 | 103.3-130.2 | 4.8 |

APPENDIX B

Girls' Stanford Scores

in

Reading

General Isochronic Equation

$$y = K_1 = \left[= r_1 t + i_1\right]$$

Equation from Mean Values

$$y = 75.3 = \left[= 1.212t - 87.26\right]$$

"b", point taken as beginning of growth

"c", approximate time required for completion of cycle

"t", age at which approximate completion of development occurs

## APPENDIX B

## GIRLS' READING SCORES

### PRE-ADOLESCENT CONSTANTS

| Case No. | I.Q. | $K_1$ | $r_1$ | $b_1$ | $c_1$ | $t_1$ | Dev. | Age Span | Scores |
|---|---|---|---|---|---|---|---|---|---|
| 1f | 100 | 63.1 | .895 | 72.6 | 84.7 | 157.3 | ±4.0 | 106-134 | 6 |
| 2f | 127 | 91.2 | 1.283 | 62.6 | 59.3 | 121.9 | ±5.0 | 84-112 | 6 |
| 3f | 107 | 69.2 | 1.022 | 66.2 | 74.4 | 140.6 | ±2.9 | 100-128 | 6 |
| 4f | 113 | 74.1 | 1.021 | 54.8 | 74.3 | 129.1 | ±3.0 | 90-118 | 6 |
| 5f | 112 | 77.6 | 1.233 | 69.8 | 53.7 | 123.5 | ±4.3 | 94-122 | 6 |
| 6f | 95 | 63.1 | 1.153 | 82.0 | 61.0 | 143.0 | ±1.9 | 109-137 | 6 |
| 7f | 90 | 60.3 | 1.254 | 79.9 | 60.6 | 140.5 | ±2.3 | 109-137 | 6 |
| 8f | 117 | 60.3 | 1.583 | 67.5 | 48.1 | 115.6 | ±1.9 | 94-110 | 4 |
| 9f | 103 | 61.7 | 1.468 | 89.0 | 51.5 | 140.5 | ±1.2 | 119-131 | 3 |
| 10f | 120 | 87.1 | 1.220 | 65.8 | 70.3 | 136.1 | ±4.1 | 95-120 | 5 |
| 11f | 81 | 50.1 | .951 | 77.6 | 79.9 | 157.5 | ±2.8 | 105-133 | 6 |
| 12f | 113 | 69.2 | 1.013 | 62.3 | 74.9 | 137.2 | ±5.3 | 91-119 | 5 |
| 13f | 111 | 72.4 | 1.071 | 69.7 | 70.9 | 140.6 | ±1.4 | 100-128 | 6 |
| 15f | 109 | 63.1 | 1.130 | 62.4 | 67.2 | 129.6 | ±3.0 | 94-118 | 5 |
| 17f | 84 | 69.2 | 1.073 | 85.0 | 70.8 | 155.8 | ±4.0 | 110-130 | 4 |
| 18f | 103 | 69.2 | 1.249 | 71.9 | 60.8 | 132.7 | ±2.4 | 99-134 | 7 |
| 19f | 115 | 79.4 | 1.232 | 65.4 | 61.7 | 127.1 | ±3.5 | 94-126 | 6 |
| 21f | 104 | 66.1 | 1.272 | 67.4 | 59.7 | 127.1 | ±2.7 | 97-125 | 6 |
| 22f | 125 | 77.6 | 1.093 | 49.6 | 69.2 | 118.8 | ±3.1 | 79-115 | 7 |
| 24f | 119 | 75.9 | 1.343 | 59.9 | 56.6 | 116.5 | ±2.6 | 80-116 | 7 |
| 25f | 118 | 93.3 | .858 | 54.9 | 98.0 | 152.9 | ±5.2 | 94-130 | 7 |
| 26f | 103 | 81.3 | 1.060 | 66.4 | 71.6 | 138.0 | ±4.4 | 99-119 | 4 |
| 27f | 117 | 75.9 | 1.106 | 71.3 | 69.1 | 140.4 | ±2.5 | 102-118 | 4 |
| 28f | 106 | 100.0 | .972 | 54.6 | 78.9 | 133.5 | ±6.2 | 86-125 | 8 |
| 29f | 102 | 56.2 | 1.303 | 75.3 | 58.3 | 133.6 | ±2.2 | 102-118 | 4 |
| 31f | 102 | 66.1 | 1.151 | 70.8 | 65.8 | 136.6 | ±3.2 | 98-134 | 7 |
| 32f | 105 | 63.1 | 1.187 | 69.7 | 64.1 | 133.8 | ±2.3 | 100-124 | 5 |
| 33f | 89 | 66.1 | 1.068 | 93.5 | 71.1 | 164.6 | ±3.6 | 120-155 | 6 |
| 34f | 96 | 69.2 | 1.641 | 78.8 | 46.2 | 125.0 | ±5.0 | 102-138 | 7 |
| 35f | 118 | 79.4 | .873 | 59.7 | 87.0 | 146.7 | ±3.8 | 93-132 | 8 |
| 37f | 140 | 91.2 | .895 | 54.8 | 84.9 | 139.7 | ±1.5 | 102-118 | 3 |
| 38f | 111 | 75.9 | 1.190 | 69.1 | 63.9 | 133.0 | ±1.6 | 100-135 | 7 |
| 40f | 129 | 100.0 | 1.611 | 72.1 | 47.3 | 119.4 | ±1.6 | 99-123 | 5 |
| 41f | 108 | 81.3 | 1.125 | 66.0 | 67.5 | 133.5 | ±3.4 | 102-130 | 6 |
| 42f | 91 | 57.5 | 1.186 | 78.5 | 64.1 | 142.6 | ±4.7 | 107-143 | 6 |
| 43f | 102 | 67.6 | 1.735 | 95.0 | 43.6 | 138.6 | ±3.2 | 111-147 | 6 |
| 45f | 128 | 100.0 | .917 | 61.2 | 82.8 | 144.0 | ±3.8 | 104-136 | 6 |
| 48f | 94 | 56.2 | 1.350 | 85.0 | 56.4 | 141.4 | ±1.2 | 114-134 | 4 |
| 49f | 109 | 69.2 | 1.195 | 60.0 | 63.5 | 123.5 | ±2.3 | 98-114 | 4 |
| 50f | 117 | 85.1 | 1.149 | 66.8 | 66.2 | 133.0 | ±0.8 | 111-123 | 3 |
| 51f | 93 | 66.1 | 1.346 | 93.0 | 56.5 | 149.5 | ±3.5 | 123-139 | 4 |
| 52f | 105 | 74.1 | .856 | 70.2 | 87.7 | 157.9 | ±1.6 | 111-143 | 6 |
| 53f | 116 | 85.1 | 1.204 | 77.8 | 63.2 | 141.0 | ±3.6 | 111-132 | 5 |
| 55f | 123 | 91.2 | 1.512 | 79.6 | 50.4 | 130.0 | ±2.1 | 105-129 | 5 |
| 58f | 95 | 66.1 | .993 | 73.0 | 76.6 | 149.6 | ±3.6 | 100-136 | 5 |
| 59f | 107 | 63.1 | 1.248 | 71.2 | 60.8 | 132.0 | ±2.3 | 106-126 | 4 |
| 62f | 114 | 72.4 | 1.322 | 86.0 | 57.5 | 143.5 | ±1.8 | 109-133 | 4 |
| 63f | 144 | 100.0 | 1.534 | 65.3 | 49.7 | 115.0 | ±2.8 | 96-120 | 5 |
| 64f | 103 | 69.2 | 1.244 | 82.3 | 61.1 | 143.4 | ±1.6 | 106-138 | 4 |
| 65f | 107 | 75.9 | .735 | 49.1 | 103.4 | 152.5 | ±3.4 | 90-126 | 5 |
| 68f | 108 | 79.4 | 1.643 | 87.8 | 46.7 | 134.5 | ±0.5 | 110-134 | 3 |
| 69f | 110 | 72.4 | 1.496 | 82.0 | 50.7 | 132.7 | ±2.1 | 107-131 | 3 |
| 70f | 109 | 77.6 | 1.441 | 74.1 | 58.7 | 132.7 | ±1.7 | 98-134 | 5 |
| 71f | 106 | 89.1 | 1.096 | 78.0 | 69.1 | 147.1 | ±2.5 | 112-136 | 3 |
| 74f | 114 | 93.3 | 1.195 | 74.9 | 63.7 | 138.6 | ±4.2 | 103-135 | 4 |
| 76f | 115 | 89.1 | 1.440 | 87.7 | 53.6 | 141.3 | ±2.2 | 114-139 | 3 |
| 77f | 114 | 95.5 | 1.462 | 76.1 | 52.0 | 128.1 | ±2.0 | 99-131 | 4 |
| 78f | 104 | 81.3 | 1.322 | 81.1 | 57.4 | 138.5 | ±1.4 | 109-133 | 3 |
| 80f | 100 | 70.8 | 1.222 | 81.0 | 62.0 | 143.0 | ±1.2 | 109-141 | 4 |
| 82f | 109 | 70.8 | .857 | 60.3 | 88.7 | 149.0 | ±3.4 | 93-121 | 3 |
| 83f | 97 | 60.3 | 1.277 | 77.2 | 59.7 | 136.9 | ±1.5 | 107-131 | 3 |
| 84f | 115 | 69.2 | 1.694 | 83.9 | 45.2 | 129.1 | ±2.0 | 107-131 | 3 |
| Mean | 109.0 | 75.3 | 1.212 | 72.0 | 65.0 | 137.0 | ±2.8 | 101.9-129.1 | 4.9 |

# APPENDIX C

## Boys' and Girls'

## Individual Reading Achievement Curves

## Illustrating

## Variability in the Fit

## of

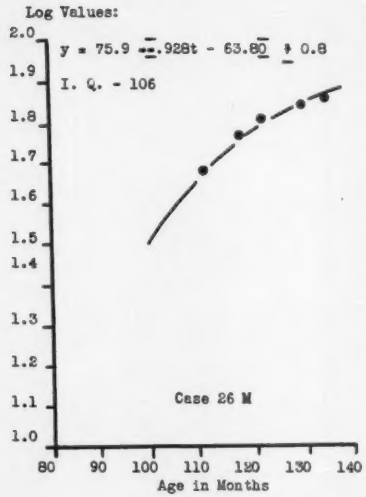
## the Various Curves

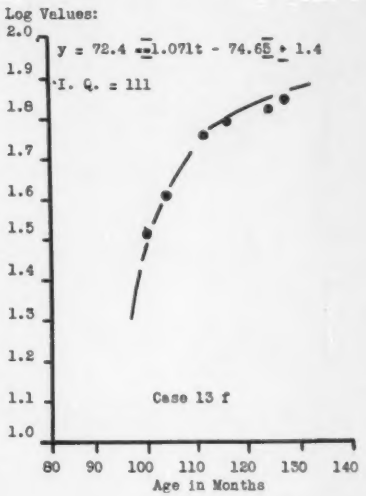
| Average Error | Cases |
|---|---|
| +1.0 | 26M - 13F |
| +2.0 | 2M - 6F |
| +3.0 | 13M - 24F |
| +4.0 | 22M - 5F |
| +5.0 | 7M - 2F |
| +6.0 | 4M - 28F |

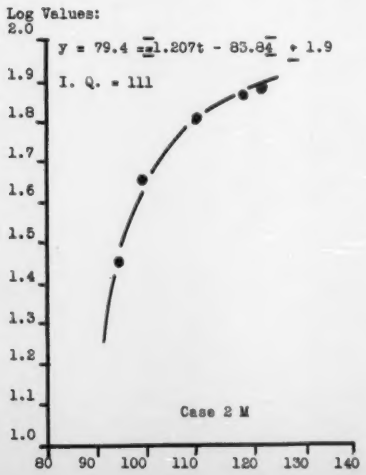
APPENDIX C

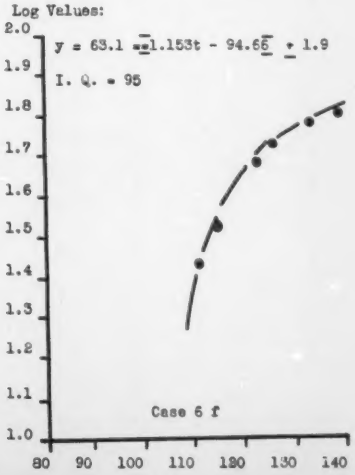
Boys' and Girls'

Individual Reading Achievement Curves

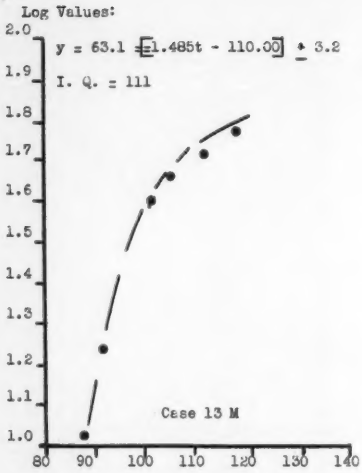


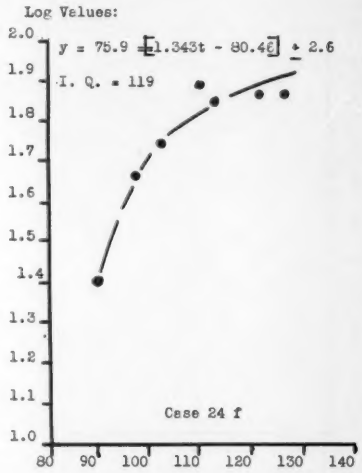



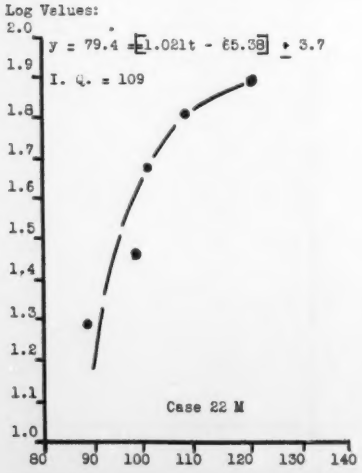



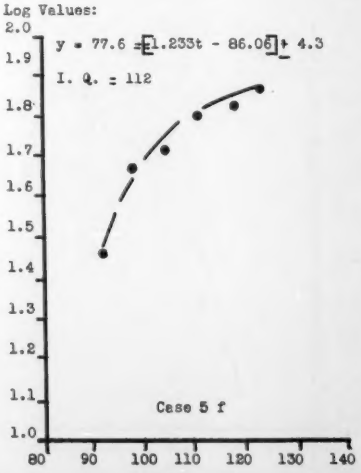



APPENDIX C (Continued)

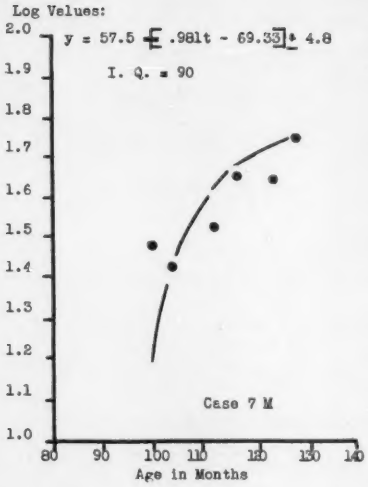


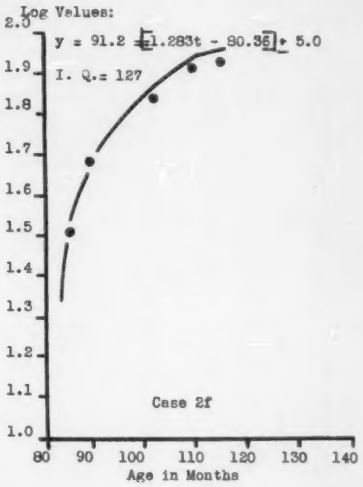



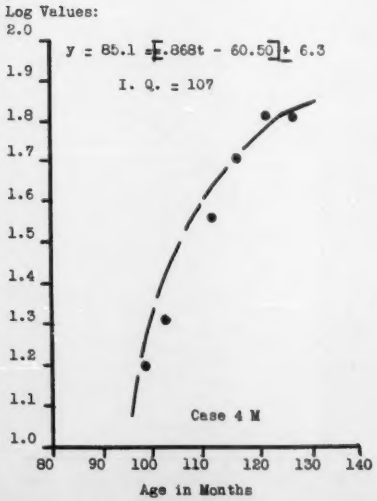



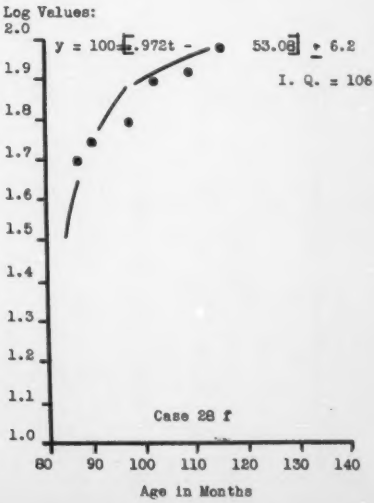



APPENDIX C (Continued)



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# THE ATTITUDES OF AGGRESSIVE AND SUBMISSIVE BOYS TOWARD ATHLETICS[1]

WILLIAM FAUQUIER

One of the least well understood and probably the most widely discussed subject in the recreational and educational curricula is athletics. Although psychologists and psychiatrists have devoted it little attention, the layman, sportswriter, coach, and physical education teacher have attached to it an inordinate number of generalizations which have little or no experimental basis.

In the first place, the contribution of athletics to the average individual has been grossly exaggerated, too much unwarranted emphasis having been given to the so-called "character value" of competitive sport. In the second place, inadequate research has been directed toward the discovery of how athletics can best serve the vast numbers of dissimilar persons who come to it not only for exercise and recreation, but as part solutions to their mental health problems.

Certainly before athletics can accomplish the many things which enthusiasts claim, something must be known about the differences between individuals and types of individuals in their needs, attitudes toward, and participation in athletic games. For example, are all boys regardless of personality factors, habits, and training interested in the same sports, in the same degree, and for similar reasons? If not, is there a quantitatively measurable difference in this respect between large blocks of similar aged individuals? And, assuming these differences to exist, what are their explanations and implications?

The following study reports an effort to describe quantitatively some of the qualitative differences in attitude toward athletics between aggressive and submissive boys of similar age, intelligence, academic standing, and physical equipment. Attempt is made, first, to illustrate the differences between these groups of boys in the way they utilize athletics for the satisfaction of basic personality needs and, second, to indicate a few of the more obvious relationships between these differences and attitudinal patterns - insofar as these patterns are reflected by overt behavior.

## PROCEDURE

Informal observation of institutional boys at play suggested that certain constant differences existed between boys in their habitual choice of games and in the degree of enthusiasm which characterized participation. Preliminary investigation proved that there was a crude correlation between the kinds of games most frequently played and the type of boy, that is, his problems and especially his conduct. Adler, a decade ago, intimated this relationship. "Games are not to be considered," he said, "as haphazard ideas of parents and educators, but they are to be considered as educational aids and as stimuli for the spirit, for the fantasy, and for the life technique of the child. The

[1] *This study was conducted at Berkshire Industrial Farm, Canaan, New York, and read at the 16th Annual Meeting of Upper New York Psychologists, New York State College for Teachers, Albany, New York, April 26, 1940.*



CHILD DEVELOPMENT, Vol. 11, No. 2 (June, 1940)

preparation for the future can be seen in every game. The manner in which a child approaches a game, his choice, and the importance which he places upon it, indicate his attitude and relationship to the environment and how he is related to his fellow men. Whether he is hostile or friendly and particularly whether he has the tendency to be a ruler, is evident in his play..." (1, page 91).

Dimock recently stated this another way: "Individuals may find in recreational activities an opportunity to satisfy basic personality needs and urges that are frustrated or inadequately satisfied by other kinds of experience. The particular fundamental drives, or desires, that may find wholesome expression in play activities include: the desire and need for novelty, adventure, and excitement; the deeply rooted necessity of social approval, attention, status, and recognition; the urge for a sense of mastery, power, success, and achievement" (5, page 36).

Proceeding upon these assumptions, the scores of a specially designed athletic questionnaire were compared for three groups of boys classified according to their behavior records.

For comparative purposes a control group of forty adolescents who were making a successful adjustment to their home and school environment were drawn from a New York Junior High School. Darrow and Heath (9) have pointed out that even the most objective attempts to relate one variable of human behavior to another have left us with the question of how much the research has dealt with differences which are fundamental and how much with nonessentials. Special effort therefore has been made to keep the variables discrete, of simple explanation and, what is more, of practical import to the problem at hand.

The carefully recorded conduct of the institutional boys was taken to represent the behavior variable and the qualitative and quantitative scores of these boys on the athletic questionnaire to represent the attitudinal variable; the problem being to compare the differences in attitude toward athletic games between the aggressive and submissive groups of individuals.

The aggressive and submissive groups were composed of 83 delinquent boys from Berkshire Industrial Farm who had been in the institution for twelve months or longer at time of study. A day by day record of misconduct was kept for the whole institutional population, the selected study group being subdivided into 42 aggressive and 41 submissive boys on the basis of conduct. By comparison with the median number of reports for all boys, each individual was classified into either one of the two behavior groups.

Whatever might have been the similarities of the boys in the two institutional groups, they have one distinct dissimilarity: the difference in their conformity to the regulations of the institution over a period of one year. The aggressive boy, compared to the recessive or submissive boy, is one who has refused more frequently to obey, has more often shirked his work and duty, and has offered more overt resistance to the rule of his fellows and staff members.

It should be pointed out that not all of the catagories in Table 1 represent typical agressive behavior. Inattention, for example, is a characteristic withdrawal mechanism and running away and attention getting may not be thought of as being aggressive in the limited sense of the word. But boys having a high general misconduct record similarly

TABLE 1

FORM USED IN THE TABULATION OF REPORTS FOR MISCONDUCT

Name . . . . . Admitted . . . . . Born . . . . .

| | | Conduct Reports by Months | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Jan. | Feb. | Mar. | Apr. | May | June | July | Aug. | Sept. | Oct. | Nov. | Dec. |
| AVOIDANCE OF RESPONSIBILITY | breach of routine | | | | | | | | | | | | |
| | shirking work or duty | | | | | | | | | | | | |
| | missing appointments | | | | | | | | | | | | |
| | inattention | | | | | | | | | | | | |
| ANTI-SOCIAL BEHAVIOR | stealing | | | | | | | | | | | | |
| | lying | | | | | | | | | | | | |
| | violence, cruelty | | | | | | | | | | | | |
| | destruction of property | | | | | | | | | | | | |
| | disobedience to gain end | | | | | | | | | | | | |
| INFANTILE BEHAVIOR | runaway | | | | | | | | | | | | |
| | temper | | | | | | | | | | | | |
| | negative-spite reactions | | | | | | | | | | | | |
| | attention getting | | | | | | | | | | | | |
| | insolence | | | | | | | | | | | | |
| | swearing | | | | | | | | | | | | |
| TOTAL | | | | | | | | | | | | | |

show a higher count for such acts as fighting, bullying, stealing, destruction of property and disobedience. The median number of reports for such aggressive acts was 17.5 for the aggressive group and 2.7 for the submissive; the former having a range of 5-83 misconduct reports and the latter from 0-12. This being so, the total number of reports for misconduct was arbitrarily taken as being representative of aggression.

All boys were given a mimeographed copy of the athletic questionnaire during a period of the school day. The questions were read aloud by the examiner and discussed as occasion demanded. Being mostly of the multiple choice variety, the replies required in most instances only a check mark. To insure some measure of reliability the answers to the questions were weighted either 1, 2, or 3 according to the degree of interest they implied. For example, the replies to the first question, "Do You Like Sports?" were weighted in the following manner: very much (3 points); a little (2 points); not at all (1 point). A maximum of 55 points and a minimum of 18 points represented the possible point range. The groups were compared by averages and dispersions for the point scores, and according to percentage differences for each question.

CHARACTERISTICS OF GROUPS STUDIED

For convenience of recording, the institutional-aggressive group will be referred to as I-A; the institutional-submissive group as I-S; and the normal-control group as N-C.

It has been suggested that the height, weight, and age differences between the three groups might be more important than the conduct dissimilarities, and, furthermore, that these factors might possibly account in a large measure for the behavior pecularities of these boys. While this notion is not entirely unfounded, it does not account for the situation in this study. The height and weight factors might conceivably be the basis for greater frustration and aggressiveness of the smaller and younger I-A individuals except for the fact that the institutional boys

TABLE 2

MEDIAN I.Q.,[2] CHRONOLOGICAL AGE, HEIGHT, WEIGHT, AND NUMBER OF REPORTS FOR MISCONDUCT; RANGE IN NUMBER OF REPORTS FOR MISCONDUCT; AND NUMBER OF BOYS IN EACH GROUP

| Group | Median I.Q. | Median age | Median height (inches) | Median weight (lbs.) | Median no. of reports for misconduct[3] | Range in no. of reports for misconduct | Number of boys |
|---|---|---|---|---|---|---|---|
| I-A | 93 | 14-0 | 61.8 | 97.8 | 41.5 | 22.5 - 151.0 | 42 |
| I-S | 93 | 15-7 | 64.1 | 115.0 | 10.3 | 0.0 - 22.5 | 41 |
| N-C | 90 | 15-4 | 64.0 | 117.9 | - | - - | 40 |

always compete in their own age and size divisions and could hardly be aggressive because of competition with older and stronger opponents. As regards the age difference, it is admitted that developmental factors surely contribute something toward the explanation of interest and activity differences between older and younger boys. These differences are, however, probably unimportant in the lives of institutional boys where athletics is given equal stress and assumes equal importance as a recreational factor for individuals of all ages.

The data of Table 4 indicate a reliable difference between the mean scores of the I-A and I-S groups. In this instance the probable error

TABLE 3

MEANS AND STANDARD DEVIATIONS FOR POINT SCORES ON ATHLETIC QUESTIONNAIRE FOR FOUR GROUPS[4]

| Group | Mean Score | Standard Deviation |
|---|---|---|
| N-C | 44.72 ± .44 | 4.68 |
| I-G | 46.66 ± .42 | 5.73 |
| I-A | 49.00 ± .40 | 3.93 |
| I-S | 43.22 ± .59 | 5.61 |

TABLE 4

PROBABLE ERRORS BETWEEN THE MEAN SCORES OF THE FOUR GROUPS

| Group | Institutional Group | | Institutional-Submissive | | Institutional-Aggressive | |
|---|---|---|---|---|---|---|
| | Difference between means | Probability of a deviation beyond $\frac{x}{P.E.}$ | Difference between means | Probability of a deviation beyond $\frac{x}{P.E.}$ | Difference between means | Probability of a deviation beyond $\frac{x}{P.E.}$ |
| N-C | 1.42 ± 1.69 | .3292 | 1.50 ± 1.51 | .3056 | 4.28 ± 1.41 | .0317 |
| I-G | | | 2.92 ± 1.61 | .1626 | 2.86 ± 1.49 | .1476 |
| I-S | | | | | 5.78 ± 1.35 | .0026 |
| I-A | | | | | | |

*[2]The Revised Stanford-Binet Scales L and M were used exclusively as the mental test criterion for the institutional groups. The Henmon-Nelson Tests of Mental Ability were used for the normal-control groups.*

*[3]The normal-control group coming from a public high school situation offered no objective conduct measure such as was available for the institutional groups.*

*[4]In Tables 3 and 4 the aggressive and submissive groups were combined to form a fourth group - the whole institutional group as represented by the symbols I-G.*

of the difference is 4.28.[5] With this in mind the following tables are offered with the intention of showing the possible dissimilarities in athletic attitude and participation between the institutional-aggressive and institutional-submissive boys. Although the differences between the point scores are reliable, the dissimilarities for any one question as set forth in the following percentage tables may be largely the function of chance. The mean of the normal-control group closely resembles that of the institutional-aggressive and institutional-submissive groups combined. This being so, its point-to-point similarity to or difference from these two groups is interesting and shows where either group approaches or diverges radically from what may be thought of as normal.

In the following tables the particular question of the athletic questionnaire is contained verbatim in the title whenever possible. When the question is not stated verbatim, the title is self-explanatory.

TABLE 5

RESPONSES TO THE QUESTION, "DO YOU LIKE SPORTS?"

| Group | Attitude toward sports | | | | | |
|---|---|---|---|---|---|---|
| | Like sports very much | | Like sports a little | | Do not like sports at all | |
| | N | % | N | % | N | % |
| I-A | 35 | 83.3 | 5 | 11.9 | 2 | 4.8 |
| I-S | 32 | 78.1 | 9 | 21.9 | 0 | 0.0 |
| N-C | 34 | 85.0 | 5 | 12.5 | 1 | 2.5 |

This question was not particularly differential. For all purposes the three groups show an almost identical interest in sports. The data in Table 6 are more discriminating.

TABLE 6

RESPONSES TO THE QUESTION, "CHECK THE TYPE OF GAMES WHICH YOU LIKE BEST"[6]

| Group | Team Games | | Individual Games | |
|---|---|---|---|---|
| | Number | % | Number | % |
| I-A | 35 | 83.3 | 7 | 16.7 |
| I-S | 28 | 68.3 | 13 | 31.7 |
| N-C | 37 | 92.5 | 3 | 7.5 |

The I-S boys prefer individual to group games. The choices of the I-A and N-C boys indicate that they are more interested in group games. Table 7 corroborates this notion.

Among the first six choices which include about 75 per cent of all responses, the boys of the I-S group list swimming, skating, and hiking - all individual sports. Those of the other two groups indicate only swimming. If all sports be classified into either group or individual

[5] *A difference or a statistical constant of any sort is not significant unless it is at least four times its probable error.*

[6] *Two choices were given: 1) Games played alone like tennis, handball, hiking, and skiing; 2) games played as a member of a team like football, basketball, and hockey.*

TABLE 7

RESPONSES TO A QUESTION ASKING THE BOYS TO CHECK THEIR FAVORITE GAME BY PLACING A ONE IN FRONT OF THE GAME THEY LIKED BEST, A TWO IN FRONT OF THE GAME SECOND BEST, A THREE IN FRONT OF THE GAME LIKED NEXT BEST, ETC.[7]

| Favorite Games | | | | | |
|---|---|---|---|---|---|
| I-A Group | | I-S Group | | N-C Group | |
| Football | 20.7% | Swimming | 16.3% | Basketball | 23.2% |
| Basketball | 14.9 | Basketball | 15.5 | Baseball | 18.4 |
| Baseball | 13.6 | Football | 12.8 | Swimming | 14.4 |
| Swimming | 11.1 | Skating | 8.8 | Football | 13.7 |
| Track | 9.5 | Hiking | 8.1 | Hockey | 6.1 |
| Hockey | 6.2 | Baseball | 8.6 | Skating | 5.3 |
| Skating | 5.5 | Tennis | 5.8 | Track | 4.3 |
| Hiking | 3.5 | Hockey | 3.9 | Hiking | 2.6 |
| Skiing | 3.5 | Track | 2.7 | Ping-pong | 2.5 |
| Ping-pong | 2.2 | Ping-pong | 2.6 | Sledding | 2.1 |
| Others | 8.4 | Others | 14.9 | Others | 7.4 |
| Total | 99.1 | | 100.0 | | 100.0 |

games regardless of the competitive factor, 42.3 per cent of the I-S boys choose individual games compared to 35.2 per cent of the I-A and 31.2 of the N-C group boys. The parity here between the N-C and the I-A groups is very close, and strictly in accordance with the preferences shown in Table 6.

Can the I-S boys' dislike of competitive group games be explained in terms of their greater insecurity and feelings of inferiority? Tables 8, 9, 10 and 11 seem explanatory.

The data of the following four tables seem to verify the notion that the game choices of the I-S boys reflect their greater inferiority, frustration, nervous tension, and insecurity. In every instance this group admits greater inadequacy, anxiety, and sense of failure. There is in these instances a close correspondence between the attitudes of the I-A and N-C groups, the I-S group apparently being divergent from normalcy in these respects.

TABLE 8

RESPONSES TO THE QUESTION, "DOES PLAYING GAMES EVER MAKE YOU FEEL BADLY AS THOUGH YOU WERE NOT AS GOOD AS OTHER BOYS?"

| Group | Degree of Inferiority Felt in Playing Competitive Games | | | | | |
|---|---|---|---|---|---|---|
| | A Great Deal | | A Little | | None at all | |
| | Number | % | Number | % | Number | % |
| I-A | 4 | 9.5 | 17 | 40.5 | 21 | 50.0 |
| I-S | 1 | 2.4 | 28 | 68.3 | 12 | 29.3 |
| N-C | 0 | 0.0 | 24 | 60.0 | 16 | 40.0 |

[7] *Five points was awarded for first choice, four points for second choice, etc. In this way a point scale of popularity was obtained. The percentages of Table 7 were obtained by dividing the total number of points cast for each sport by the total number cast for all sports.*

TABLE 9

RESPONSES TO THE QUESTION, "DOES IT MAKE YOU ANGRY TO LOSE IN SPORTS OR GAMES?"

| Group | Frequency of Anger Felt Through Defeat in Games | | | | | |
|---|---|---|---|---|---|---|
| | Often Felt | | Sometimes Felt | | Never Felt | |
| | Number | % | Number | % | Number | % |
| I-A | 0 | 0.0 | 28 | 66.7 | 14 | 33.3 |
| I-S | 0 | 0.0 | 34 | 83.0 | 7 | 17.0 |
| N-C | 1 | 2.5 | 24 | 60.0 | 15 | 37.5 |

TABLE 10

RESPONSES TO THE QUESTION, "DOES IT MAKE YOU NERVOUS WHEN SOMEONE IS BEATING YOU IN A GAME?"

| Group | Emotional Experience When Losing in a Game | | | | | |
|---|---|---|---|---|---|---|
| | Very Nervous | | A Little Nervous | | Not Nervous | |
| | Number | % | Number | % | Number | % |
| I-A | 8 | 19.1 | 11 | 26.2 | 23 | 54.8 |
| I-S | 5 | 12.2 | 20 | 48.8 | 16 | 39.0 |
| N-C | 3 | 7.5 | 10 | 25.0 | 27 | 67.5 |

TABLE 11

RESPONSES TO THE QUESTION, "DO YOU LIKE TO PLAY AGAINST STRANGERS?"

| Group | Attitude Toward Playing Against Strangers | | | | | |
|---|---|---|---|---|---|---|
| | Dislike to Play Against Strangers | | Dislike a Little to Play Against Strangers | | Like to Play Against Strangers | |
| | Number | % | Number | % | Number | % |
| I-A | 4 | 9.5 | 8 | 19.1 | 30 | 71.4 |
| I-S | 5 | 12.2 | 9 | 21.9 | 27 | 65.9 |
| N-C | 4 | 10.0 | 6 | 15.0 | 30 | 75.0 |

As a further check on athletic attitudes and preferences, the data of Tables 12 and 13 reinforce the belief that the I-S individuals do not consider athletics as the best means of satisfying their needs.

The I-S boys admit relatively lesser physical prowess in athletics than the I-A and N-C individuals. The I-A boys rate themselves as being better than average most frequently. The I-S group also looks upon athletics with less enthusiasm than the others. Basically this latter group are more withdrawn and seem less inclined to competitive activities and show a proclivity to pursue hobbies which are as a rule individualistic in nature. When they do enter into competitive athletics, their attitudes toward success are different than those of the I-A boys. Table 14 is further illustrative.

The boys of the I-A group voice a relatively stronger bent for success

TABLE 12

RESPONSES TO A QUESTION ASKING THE BOYS TO RATE THEMSELVES AS ATHLETES

| Group | Self Rating as an Athlete | | | | | |
|---|---|---|---|---|---|---|
| | Better than Average | | Average | | Worse than Average | |
| | Number | % | Number | % | Number | % |
| I-A | 11 | 26.2 | 14 | 33.3 | 17 | 40.5 |
| I-S | 3 | 7.3 | 16 | 39.0 | 22 | 53.7 |
| N-C | 4 | 10.0 | 16 | 40.0 | 20 | 50.0 |

TABLE 13

RESPONSES TO THE QUESTION, "WHAT IS YOUR FAVORITE HOBBY?"

| Hobby | Numbers and Percentages Shown by Groups | | | | | |
|---|---|---|---|---|---|---|
| | I-A Group | | I-S Group | | N-C Group | |
| | Number | % | Number | % | Number | % |
| Athletics | 16 | 41.0 | 10 | 25.0 | 14 | 40.0 |
| Collecting | 6 | 15.4 | 4 | 10.0 | 4 | 11.4 |
| Cooking | 5 | 12.8 | 2 | 5.0 | 0 | 0.0 |
| Model Making | 4 | 10.3 | 4 | 10.0 | 1 | 2.9 |
| Travel | 1 | 2.6 | 3 | 7.5 | 0 | 0.0 |
| Hunting | 0 | 0.0 | 0 | 0.0 | 3 | 8.6 |
| Others | 7 | 18.0 | 17 | 42.5 | 13 | 37.1 |
| Totals[8] | 39 | 100.1 | 40 | 100.0 | 35 | 100.0 |

TABLE 14

RESPONSES TO A QUESTION ASKING THE BOYS TO CHECK A SENTENCE BEST ILLUSTRATIVE OF THEIR ATTITUDE TOWARD PLAYING OR WINNING IN A GAME

| Group | Attitude Toward Winning in Competitive Games | | | | | |
|---|---|---|---|---|---|---|
| | Would Try Anything to Win | | Would Try Anything but Cheating | | Playing Only is Important | |
| | Number | % | Number | % | Number | % |
| I-A | 2 | 4.8 | 28 | 66.6 | 12 | 28.6 |
| I-S | 0 | 0.0 | 24 | 58.6 | 17 | 41.5 |
| N-C | 0 | 0.0 | 18 | 45.0 | 22 | 55.0 |

than the I-S and N-C boys. On the other hand the typical I-S individual indicates more concern about winning than the N-C boys who profess substantially more mature interest in mere participation regardless of success. These dissimilarities are demonstrated in another way in Table 15.

While the data of Table 15 show a general agreement between the groups that "playing harder" is the best solution to being cheated, the attitudes of the I-A boys suggest a greater aggressive tendency in this situation

[8]*Some boys professed to have no hobby.*

and a greater proclivity to fight and argue. As might have been anticipated, the I-S boys admit a greater inclination to withdraw and significantly lesser tendency to fight or argue. Although the small differences shown in these data probably owe their occurrences to sampling errors, they are related closely to the trends shown in the previous tables.

The importance of athletic prestige is brought out in Table 16. Although there is little disagreement between the two institutional groups, the contrast with the N-C boys is interesting.

Despite a professed slighter interest in athletics, the I-S boys show a stronger identification with athletically gifted companions. The value placed upon this type of attachment by the N-C boys is significantly less.

The data in Table 17 illustrate the institutional boys' significantly

TABLE 15

RESPONSES TO A QUESTION INQUIRING ABOUT THE REACTIONS OF THE BOYS TO A SITUATION IN WHICH THEY WERE BEING CHEATED BY THEIR OPPONENTS IN A COMPETITIVE GAME

| Group | Reaction When Being Cheated by Opponents | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Cheat Yourself | | Play Harder | | Argue with Referee | | Stop Playing | | Start a Fight | |
| | N | % | N | % | N | % | N | % | N | % |
| I-A | 1 | 2.4 | 29 | 69.1 | 4 | 9.5 | 3 | 7.1 | 5 | 11.9 |
| I-S | 0 | 0.0 | 33 | 80.5 | 2 | 4.9 | 5 | 12.2 | 1 | 2.4 |
| N-C | 2 | 5.0 | 31 | 77.5 | 5 | 12.9 | 0 | 0.0 | 2 | 5.0 |

TABLE 16

RESPONSES TO THE QUESTION, "THINK OF YOUR BEST PAL. WOULD YOU LIKE HIM WHETHER HE WAS AN ATHLETE OR NOT?"

| Group | Attitude Toward Friend If He Were Not an Athlete | | | |
|---|---|---|---|---|
| | Would Still Like Him | | Would Not Like Him as Much | |
| | Number | % | Number | % |
| I-A | 32 | 76.2 | 10 | 23.8 |
| I-S | 29 | 70.7 | 12 | 29.3 |
| N-C | 34 | 85.0 | 6 | 15.0 |

TABLE 17

RESPONSES TO THE QUESTION, "DO YOU DISLIKE SPORTS IN WHICH YOU HAVE TO RUB AGAINST OR BE IN CLOSE PHYSICAL CONTACT WITH OTHER BOYS?"

| Group | Attitude Toward Physical Contact with Other Boys | | | | | |
|---|---|---|---|---|---|---|
| | Dislike Very Much | | Dislike a Little | | Do Not Dislike | |
| | Number | % | Number | % | Number | % |
| I-A | 4 | 9.5 | 11 | 26.2 | 27 | 64.3 |
| I-S | 5 | 12.2 | 13 | 31.7 | 23 | 56.1 |
| N-C | 7 | 17.5 | 22 | 55.0 | 11 | 27.5 |

greater unconcern about being in close bodily contact or to what Freud has called "rubbing games." The normal control boys seem to have already changed more completely to general heterosexual standards and voice a strong conscious dislike for close physical contact with members of their own sex.

TABLE 18

RESPONSES TO THE QUESTION, "DO YOU LOOK UP TO A GREAT ATHLETE LIKE JACK DEMPSY OR BABE RUTH?"

| Group | Amount of Admiration for Famous Athlete | | | | | |
|---|---|---|---|---|---|---|
| | Very Much | | A Little | | None at All | |
| | Number | % | Number | % | Number | % |
| I-A | 22 | 52.4 | 9 | 21.4 | 11 | 26.2 |
| I-S | 22 | 53.6 | 14 | 34.2 | 5 | 12.2 |
| N-C | 21 | 52.2 | 11 | 27.5 | 8 | 20.0 |

## SUMMARY DISCUSSION

A reliable statistical difference between the means of the point scores of aggressive and submissive institutional boys on an athletic questionnaire has been shown to exist. This difference corroborates the notion that play habits are not isolated and disconnected factors in a boy's personality which may be moulded or remoulded at will, but that they are symptoms reflective of larger and more complicated systems of thinking, feeling, and acting which have the most intimate affective connections with the highly elaborated tissue-needs of the individual. This is to say that a boy who cheats, argues, fights, cries, or withdraws in athletic games cannot be changed into a well-adjusted individual, as many wish to believe, simply by discipline or exemplary leadership on the athletic field.

The aggressive boys seem to carry over into athletics many of their characteristic behavior tendencies or patterns. Their attitudes suggest that they prefer competitive group athletics which satisfy their hyperactive and dominance seeking natures. Basically they seem more interested in winning, less nervous, and less easily discouraged. They rate themselves more favorably as athletes and exhibit a stronger tendency to argue and fight when frustrated. In a previous study in which substantially the same three groups of subjects were used, the aggressive boys[9] showed a surprisingly greater propensity for violent overt reaction than was the case of the boys in the other two groups (7, p. 234).

Contrasted with the aggressive group, the submissive boys voice more interest in noncompetitive, individually played games. They pretend less drive to win, admit greater nervousness, anger, and feelings of inadequacy and seem to have slightly stronger identifications with famous athletes and athletically gifted companions.

The attitudes of the normal control group varied, at one point being similar to the attitudes of the aggressive boys and at another appearing to have more in common with the submissive boys.

[9] *They were referred to as institutionally-maladjusted rather than as aggressive in this study.*

The percentage differences set forth in the data of the various tables may owe their occurrences to sampling errors; but if these differences are largely functions of chance, how can the internal consistency of the data be explained? Nevertheless, this summary must be thought of as being based on what appears to be consistent rather than reliably demonstrated trends.

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# HEALTH AND DEVELOPMENT OF A GROUP OF NURSERY SCHOOL CHILDREN

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The advantages of standards of physical and mental growth, whereby individual children may be rated against the norms established by a group, have been fully stated. Within the wide scope of new studies in child behavior, the teacher and parent must always return to the physiological limits within which children are functioning. It is valuable to know not only the central tendencies of groups, but also how wide are the fluctuations which may be expected.

The studies reported here of two to three-year old children are not extensive in the number of subjects, but they offer intensive treatment and introduce details for comparison which are not often included. The various measures of health and development are all for the same subjects. Too often a confusing view of children may be gained by putting together the results of studies with different groups such as the feet of one group, the eyes of another, the sleep of another and perhaps the eating behavior of a fourth.

This is a description of 66 healthy nursery school children on ordinary home regimes, enrolled in the junior nursery school of the New York State College of Home Economics at Cornell University during the five years, 1932-37. Instead of brief samples taken for a week or two at different times of year, happenings of nearly every day were recorded throughout the period during which each child was enrolled. Over 13,000 days of these nursery school children were analysed, with about half of these days at home and half, spent at nursery school.

In addition to the study of the histories of infancy and physical examinations, the events for each day during the school year were coded into numbers and punched into cards which were sorted on Hollerith machines. The information included sleep, eating and nervous behavior at the noon meal in the nursery school, bowel movements, enuresis, outdoor play time, along with facts about the weather, season of the year and other details. This made it possible to determine what children of this age level usually do and how they vary from these norms at different times of year and under changing weather conditions. It was also possible to compare the regimes and development of different types of children such as "good" eaters in contrast to "poor", over-weight children versus underweight, those susceptible to colds with those resistant. The results of these comparisons are being published elsewhere (6), (7), (8).

During the course of the study, most of the staff members were the same. In addition, nursery school procedures were comparable.

These 66 children, 12 to 15 per year, really constitute five different samples drawn from the community. While they do not represent children at large, it is fair to assume that they are representative of those from professional groups, fortunate for the most part in their homes and health regimes.

The age range was left wide in order to utilize the data of all the junior children during the eight months of the school year. The median

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age at beginning school was 2 years 7 months. The middle 50 per cent fell between 2 years 4 months and 2 years 10 months, with the youngest child of the group 1 year 11 months and the oldest, 3 years 3 months. The median ages of the boys and the girls were the same and likewise the limits for the middle 50 per cent of boys and girls. There were 31 girls in the group and 35 boys.

In order to give a view of what nursery school children within this age range are like, the data whenever possible were put into three measures; the median to describe the central tendency of the group; the interquartile range or the limits of the middle 50 per cent of the children, showing how closely they cluster about the median and the width of the average range; and finally the total range to indicate how far apparently normal children may be from the median and to mark the outer boundaries of the group.

When single scores per child were given, such as percentage of hemoglobin or weight at beginning school, the median represents the mid-point of these single determinations. But when each child had a number of scores such as hours of sleep per night for about 200 nights, the medians and interquartile ranges were gained from averaging similar points in the distributions of all the children. In this way, the average range in behavior could be learned.

## INFANT DEVELOPMENT

Infant histories were taken by the pediatrician from the mothers at the beginning of nursery school.

### Age of Parents

The median age of the mothers at birth of these children was 30 years, ranging from the youngest, 22 years of age to the oldest, 41. The middle half of the mothers fell between the ages of 25.5 and 34 years.

The median age of the fathers was 33, with the interquartile range between 28 and 37 years and the total range between 23 and 49 years. When these medians are compared to the latest figures on the average age of fathers and mothers in upstate New York (5), we find the average age of fathers of babies born alive was 31.67 years, and of mothers, 27.49. So in comparison to the general population in this section, the parents of these children were about two years older.

### Birth Weights

The median birth weight reported by the mothers was 7.56 pounds for the group with the mid-point for the girls at 7.38 and the boys 7.63 pounds. These weights may be compared to the birth weights gained from a study in Broome County, New York for the months of April, 1939, to December, 1939 (5). This showed the average weight of 2,402 males at birth as 7.47 pounds, and of 2,313 females as 7.15 pounds. By comparison the nursery school children started life as heavier babies.

### Feeding and Development

The length of breast feeding for these children ranged from none at all to ten months, with a median of 1 1/4 months for the group. This

was considerably less than the mean of 3 1/2 months which Bizal (2) reported in her study of 657 babies in villages of New York state. While 12 per cent of Bizal's children had never been breast fed at all, 25 per cent of the nursery school children were never breast fed.

Most of the children had supplementary foods added to their formulas early such as cod liver oil or a substitute, orange juice and egg yolk. Cereal was started at 4 or 5 months in most cases. Strained vegetables and fruits were added about this time.

Few food idiosyncracies of infancy were reported except for three children who were said to be sensitive to egg.

Infant schedules of feeding and sleeping were reported as regular in nearly every case, often with sun baths and daily outdoor airing.

The median age of the first tooth was at 6 3/4 months, which is somewhat earlier than 7.5 months reported by Bizal (2). The middle fifty per cent of the children had their first teeth between 5 and 9 months. However, one mother reported a tooth as early as 3 1/2 months and another as late as 13 months.

The median age of first walking was 14 months, later than the mean for Bizal's children which was 12.7 months. Fifty per cent walked between 12 and 15 months. The earliest reported was 9 months and the latest 18 months.

Few early diseases were reported. One-third of the group had had no sicknesses up to the time of nursery school. Five had had whooping cough; 9, measles; 5, tonsillitis; 1, mumps; and 3, chicken pox. Several had had digestive difficulties and complications from colds.

In immunization, practically all had had toxin-antitoxin or toxoid for diptheria, and smallpox vaccinations.

The histories revealed that 21 or practically one-third of the group had sucked their thumbs.

Early operations included 5 with tonsils removed; 2, adenoids; 3 circumcision and 1 operation for harelip.

## STATUS AT BEGINNING NURSERY SCHOOL

### Physical Development

Weight. On entrance to nursery school at the median age of 2 years, 7 months, the physical examination of the children revealed that the median weight for the girls was 31.38 pounds and for the boys, 33.19. The total range for the group was from 26.69 pounds for the smallest girl, up to 42.0 for the heaviest boy. The norms of Peatman and Higgons (10) of children receiving "a relatively optimal degree of private pediatric care and home supervision," gave for girls, 29.5 pounds and for boys 31.4, at 30 months of age. The nursery school children were heavier than these favored subjects.

Height. In height, the median for the total group was 37.1 inches, with the median for the girls, 36.6 and for the boys 37.3. Peatman and Higgons found that their children at 30 months were 35.8 inches tall for girls, and 36.3 inches for boys. In height also, the nursery school children appeared superior.

Percentage Over or Under Weight and Height. Compared to the averages given by the New York State Department of Health, the median child of the

group was 6 per cent over weight for his height and age. Of course it must be recognized that comparison to such averages yields but crude measures which do not take into consideration differences of body build. The middle fifty per cent of the children ranged from 1 to 11 per cent over weight with a total range from 22 per cent over weight to 9 per cent under weight. Though the medians for the boys and girls were the same, the ranges for the middle fifty per cent in each group show that the girls tended to be more over weight than the boys.

Compared to the state averages for height, the median child was 5 per cent over height for his age. The middle fifty per cent of the children were from 2 to 8 per cent over height with the shortest but 2 per cent less than the state average and the tallest, 13 per cent over height. The distributions for the boys and girls were similar to those of the group with a tendency shown for the boys to be somewhat taller for their ages than the girls.

Weight-Height Index. The median weight-height index for the group, that is the weight in pounds divided by the height in inches, was .88. There was little variation between the sexes. The middle fifty per cent of the children had indexes ranging between .82 and .93. Standards of the children at Merrill-Palmer (16) at 31 months gave the girls an index of .833 and the boys, .855. In comparison, the nursery school children at Cornell appear well developed as a group.

Rate of Growth Since Birth. To discover how rapidly the children had been growing before coming to nursery school, the birth weights were subtracted from the weights at beginning school and divided by the age in months. Thus the median gain per month since birth for the group was .78 pounds, or roughly 3/4 of a pound, with the middle fifty per cent of the children having gained between .70 and .86 pounds per month. The slowest growing of the group had gained but .63 pounds per month versus the fastest who had gained 1.05 pounds per month. It is recognized that this rate of gain had not been steady and even, but it offered a means of roughly separating the children according to this factor. These figures showed little variation for the sexes, although there were more boys in the high 25 percentiles than girls.

Muscular Development. Muscular development was subjectively rated by the pediatrician on a scale of four pluses. One plus was accorded very poor musculature; two, a low average; three, good; and four was reserved for unusually fine development. The group was almost equally divided between the three and two plus scores, leaving only 4 with the four-plus rating of excellent and only 3 with the one plus rating of very poor musculature.

Tissue Tone. The ratings for this characteristic were similar to those for muscular development. Seven children were given four pluses; two children, one plus; and the rest were divided almost equally between two and three pluses.

Posture. Forty-seven or 71 per cent of the children had straight backs, 10 showed exaggeration of the lumbar curve, and 6 were drooping.

Shoulders were usually even, but 28 children or 44 per cent had winged shoulders.

Chests were erect.

Thirty-two of the children or almost half had prominent or slightly prominent abdomens.

Most of the children had straight legs, but 22 or a third had knock-knees of one or both legs and 7 showed bowing of the tibia.

Feet were usually straight, but 23, or a third, revealed pronation of one or both feet, some slight and others marked. This was less than was found in the group studied by Bloxsom (3) who noted among 154 children between two and four years of age, 45 to 50 per cent of the arches were in a developing or not developed state.

Skin. The skin of 19 children, or 29 per cent, showed evidences of eczema or patches of roughened skin.

Eyes. The eyes of 17 children, or 26 per cent, showed at least occasional strabismus of one or both eyes.

Tonsils. Tonsils of six of the children had been removed. Ten others showed signs of infection. This would give 16 cases of infection or 24 per cent of the group.

Teeth. The average number of teeth was 19, ranging from 16 to 20. Possibly as a result of superior home environment and care, repeated examinations showed the teeth clean and without cavities. This contrasts to the report of Pyle and Drain (11) who examined children from the Iowa Child Welfare Station. They found among the three-year-old children, 0.91 cavities per child among the boys and 0.65 cavities per child among the girls. And the percentage at this age level having defective teeth was 23.5 for the boys and 24.5 among the girls.

Lungs and Heart. Lungs and hearts of all the children were normal.

Umbilicus. Five children had small hernias. Five others had hernias that were fairly prominent.

Blood Analysis. In the fall, 22 children, or one-third, had hemoglobin below 80 per cent.[2] The median hemoglobin for the group was 81, with an interquartile range of 76 to 88 per cent and a total range of 70 to 92. The median blood count was 4,290,000 red cells.

Urinalysis. Tests for sugar were positive for 12 children, or 18 per cent of the group, at the beginning or sometime during the year, with repeated tests proving negative. In the experience of the authors, positive tests for sugar are fairly common among children of this age. Tests for albumen were given for only two of the children.

## Mental Development

The first Merrill-Palmer tests given by the psychological examiner revealed the median score to be an I.Q. of 113. The interquartile range was 106 to 125 with a total range of 82 to 153. Studies now in preparation, covering a ten year span, also give 113 as the mean I.Q. for the initial Merrill-Palmer tests in the nursery school.

## DEVELOPMENT DURING SCHOOL YEAR

## Physical Growth

Average Gain in Weight. It was impossible to compare total gains in weight for the year because of different lengths of time the children were enrolled. Therefore the rate of gain was computed by dividing the total gain by the number of weeks between the first and last weighings of the year. The median gain in weight per week for the group was 1.90

[2] *The Dare hemoglobinometer was used.*

ounces. For the girls it was 2.00 and for the boys 1.84. The total range for the group was from 1 to 5 ounces per week.

Average Gain in Height. Likewise the average gain in height per month was computed. Here the median was .25 for the group and for both boys and girls, with a total range of .03 to .40 inches per month.

Mean Deviation in Weight per Week. Again it is recognized that gains are not steady but rhythmical. How much children may be expected to vary from week to week in their weight gains is of interest. The deviations from the mean were computed and averaged for each child. The median for the group was 2.93 ounces with a total range of from 1.73 ounces to 5.11 deviation from the mean per week.

Eating Behavior

Measures. Records of the noon meal at nursery school were kept by the teacher at each table for each child. These included how long the child spent eating his meal; how much of each food was consumed and the order in which different foods were eaten. The total amount consumed was computed in arbitrary units, roughly equivalent to 20 calories.

To know the relationship between the amount a child ate and how long it took him, an efficiency score was determined by subtracting the time in minutes from 100 and to the result adding the number of units. A discussion of eating efficiency and its interpretation has already been made (6), (7), (8), (15).

The norms for this group of children show that the median time required for the nursery school meal was 45 minutes with the middle fifty per cent of the meals ranging from 37 to 55 minutes and a total range of 10 minutes to 89. Though this time is longer than has been reported by other nursery schools, it may be partially explained by the method of table service which allowed the children to help themselves to second servings, to remove their dishes from the table, and perhaps more independence in eating and more social participation.

The median number of units eaten was 25 with an interquartile range of 21 to 30 and a total range of 3 to 49 and more. The median amount would be approximately equivalent to 500 calories for the meal.

The eating efficiency scores, computed as described, ranged from 30 to 100 and more, with an interquartile range of 71 to 90 and a median of 81.

Selection of Foods. Preferences of the children were indicated by the order in which foods were eaten and the amount of second servings to which they helped themselves. The median for eating breadstuffs and protein foods fell at second place. With potatoes and vegetables it was third. This seems to show that the children were relatively more consistent in their second and third choices than in first and last, and that breadstuffs and protein foods were more popular than potatoes and vegetables. Space for milk was not included on the cards, but the impression of the observer was that it was often among the last choices.

The plan for serving the meal was for one tablespoon of each food and one sandwich to be served each child by the teacher. When this first dinner was eaten, the child served himself to second helpings. Five tablespoons of dessert were given for first servings and children could then help themselves to more. The median amounts taken were 2 sandwiches,

2 1/3 tablespoons of protein food, 2 1/2 tablespoons of vegetables and 3 tablespoons of potatoes. Two and one-half tablespoons of dessert were the median second serving. Thus servings for the total meal included the median amounts: 3 1/3 tablespoons of protein food, 3 1/2 tablespoons of vegetables, 4 tablespoons of potatoes, 3 sandwiches, 1 cup milk and 7 1/2 tablespoons of dessert. The children averaged from 3 to 11 per cent of the time when they took no seconds of the dinner foods, and as high as 40 per cent of the time when they took no seconds of dessert.

Nervous Behavior at Noon Meal. During four years of the study, records were taken during the noon meal recording "nervous" or restless movements shown by the children while they were eating. Repeated five-minute observations were made such as those described by Olson (9). The types of nervous behavior most frequently exhibited were reported and the number of types shown during the five-minute observation periods.

The median number of forms per five minutes was three. In the middle fifty per cent of the meals, the children averaged from 2 to 4 forms and in the total range of meals there was no nervous behavior to 8 and more types in a five minute observation.

The types of nervous behavior which were studied have been described (6). The names refer to the part of the body most involved in the restless movements, i.e., "respiratory: hiccoughing, barking, sobbing, sighing, yawning, snuffing, blowing through nostrils, whistling inspiration, exaggerated breathing, clearing throat, making sucking or smacking or chewing sounds." The types which these children showed in the order of their frequency may be seen in Table 1 and were: bodily, pedal, manual, oral, vocal, bucco-cervical, respiratory, hirsutal, facial, vocal-repetitional, nasal, aural, ocular, kinetic-repetitional, alimentary and genital.

In from one-half to two-thirds of the meals, no part of the meal was

TABLE 1

PERCENTAGE OF TIME DIFFERENT TYPES OF NERVOUS BEHAVIOR WERE SHOWN DURING NOON MEAL AT NURSERY SCHOOL

| Type of Nervous Behavior | Median | Interquartile Range | Total Range |
|---|---|---|---|
| | Per Cent of Time | | |
| Bodily | 73 | 54 - 86 | 0 - 100 |
| Pedal | 53 | 24 - 77 | 0 - 100 |
| Manual | 39 | 14 - 65 | 0 - 100 |
| Oral | 38 | 15 - 62 | 0 - 100 |
| Vocal | 19 | 0 - 48 | 0 - 100 |
| Bucco-Cervical | 10 | 0 - 30 | 0 - 100 |
| Respiratory | 4 | 0 - 23 | 0 - 100 |
| Hirsutal | 3 | 0 - 24 | 0 - 100 |
| Facial | 0 | 0 - 19 | 0 - 100 |
| Vocal-Repetitional | 0 | 0 - 17 | 0 - 100 |
| Nasal | 0 | 0 - 13 | 0 - 100 |
| Aural | 0 | 0 - 5 | 0 - 100 |
| Ocular | 0 | 0 - 2 | 0 - 100 |
| Kinetic-Repetitional | 0 | 0 - 0 | 0 - 100 |
| Alimentary | 0 | 0 - 0 | 0 - 100 |
| Genital | 0 | 0 - 0 | 0 - 75 |

outstandingly high or low in frequency of restless movements. When there were differences, the higher frequencies tended to occur at the middle of the meal. The lower frequencies tended to occur at the beginning or end of the meal.

These results indicate a good deal of restless movement while eating. Large body movements such as twisting and squirming were so common as to be considered characteristic of this age, as well as localized movements of the hands and feet and of hand to mouth, and meaningless vocalizing. Restlessness more evident at the middle of the meal may be associated with the effort to finish the dinner foods. The decrease in nervous behavior at the end may be associated with eating the dessert.

Sleeping Behavior

The children's sleep was reported by the teachers for nap in the nursery school and by the parents for naps at home and night sleep. Due consideration must be given to the difficulty of telling accurately whether another person is awake or asleep at any given moment. The trends obtained, however, are believed to be fairly representative.

Nap. The time each child went to bed was noted, and the time he became quiet and apparently dropped asleep. The interval between these two, called the sleep-going time, has been included for both afternoon and night sleep.

Analysis shows that the median time to bed at nap was 12:41 o'clock with the children falling asleep quickly, that is in 20 minutes or less. This may be compared favorably to the study of naps by Scott (14) where the average time taken to go to sleep for a group of nursery school children, 22 to 53 months of age, was 38 minutes. The median length of naps was 77 minutes which was close to the average length for Scott's children which was 73 3/4 minutes. The middle fifty per cent of the naps ranged from 57 to 99 minutes with a total range from no nap at all to three hours and more. Only 8 per cent of the days did the children average no naps at all.

Night Sleep. Records of the night sleep show that the children went to sleep quickly at night also, that is in 20 minutes or less and that they were asleep by 7:15 P.M. with the range for the middle fifty per cent between 6:45 and 7:45. However at times the children were asleep as early as six and as late as 9:30.

The median number of hours slept at night was 11 hours and 27 minutes, with the range for the middle fifty per cent of nights between 10 hours and 56 minutes and 12 hours. On some nights however, certain children slept 8 hours and 25 minutes or less and on other nights 13 hours and more. The length of time in bed at night reported for the median Merrill-Palmer child (16), 24 to 36 months, was 11 hours and 44 minutes. But we do not know how long he was in bed before going to sleep.

Twenty-four Hour Sleep. The median amount of sleep in 24 hours, including nap and night was 12 hours and 43 minutes with an interquartile range of 11 hours, 59 minutes to 13 hours, 21 minutes. The total range of sleep for nap and night was from less than 8 hours, 25 minutes to 15 hours, 30 minutes.

In a study of sleep by Reynolds and Mallay there were eight preschool children, two years to two years and 11 months. The mean time to go to

sleep at night was an hour, the mean night sleep was 11 hours, 1 minute and the mean total sleep was 12 hours, 30 minutes. This was a summer study. By comparison, the children in this study fell asleep more promptly and slept longer both at nap and night.

The median time of getting up in the morning was at 6:52 A.M. On the middle fifty per cent of days, the children got up from 6:22 to 7:14 A.M. At times, however, the children would get up before five or as late as 8:30.

Outdoor Play

The median amount of outdoor play time which these children had was 135 minutes a day. The middle fifty per cent of the days they had 85 minutes to three hours and more. Only two per cent of the days did the children average no playtime outside.

Elimination

Preschool children have so recently left behind infantile practices of elimination that it is of interest to know what stages they have reached toward adult standards of bladder control and defecation.

Enuresis. Records of enuresis in terms of bed-wetting at night and at naps were kept by the parents at home and by the teachers at nursery school. On the average, the children were dry 79 per cent of the days and nights. However, when the children were ranked according to the percentage of time they were dry at both night and nap during the year, it shows the median child dry 91 per cent of the time, with the middle fifty per cent of the children dry from 69 to 98 per cent. The total range was from 4 to 100 per cent. Eight of the children were dry all the time. At nap, the median child was dry 99 per cent of the days, with the middle half dry at nap from 96 to 100 per cent.

Over half of the nights, the children were taken up once for the toilet. Twenty-one per cent of the nights they were not taken up at all, and 24 per cent they were taken up twice and more.

Bowel Movements. The number of bowel movements per day and the times which they occurred were recorded for the children both on the days at home and the days at school. When the children were ranked according to the proportion of days on which there were no movements, a few tended to miss movements as often as 15 to 18 per cent of the days, while 17 of the group never missed a day. The median of the group missed one per cent of the days, with the middle half of the children not having movements from zero to three per cent. Averaging the distributions shows that 68 per cent of the days there was one movement, 25 per cent, two movements and 4 per cent, 3 movements and more. Only 3 per cent of the days did the children average no movements at all.

In spite of the usual teachings of hygiene that bowel movements should occur regularly after breakfast, the greater proportion, or an average of 42 per cent of the days, the movements were in the afternoon or evening, and 32 per cent of the time they were in the morning. On 18 per cent of the days, there were movements in both morning and afternoon.

Sickness

How much children of preschool age are sick was a question thought

worth answering for this group of 66 children. In the attendance book, the days which they were absent from school were recorded and the reasons for the absences as given by the parents. These reasons have been classified under five headings. Colds refer to respiratory infections; digestive upsets to difficulties of the alimentary tract. Diseases and infections are self-explanatory. Under "observation" are included those absences when a child was tired or thought to be coming down with a cold or other difficulty.

Compared to reports from other nursery schools, the attendance during these five years was unusually good. Conrad and Jones (4) report that the days of absence in the nursery school of the University of California were 34.5 per cent, which is similar to the report by Anderson (1) at Minneapolis and Bott (13) at Toronto.

The median per cent of school days for all causes was 16 per cent with the middle half of these children being absent from 10 to 22 per cent of the possible school days. One child was absent as little as 3 per cent of the time, while at the other extreme another lost 46 per cent. However, in order to make a comparison with the figures gained by the investigators noted above, the per cent of possible school days on which the children were absent for each of the five years was: 13, 15, 21, 16 and 20 respectively.

The median per cent of total school days absent because of sickness was 13 per cent with colds causing from 60 to 77 per cent of the sickness. Ten per cent of the total school days was lost because of colds, the middle fifty per cent of the children losing from 6 to 16 per cent. With some, however, colds caused as little as 2 per cent absence, while others lost as much as 44 per cent of the school days. Compared to the data from Merrill-Palmer (16), where the median child (24 to 41 months) was absent 23 per cent of school days and 18 per cent of the school days for colds, the children here appeared unusually healthy.

The median number of colds during the school year was 4 with the middle half of the children having from 3 to 6 and the total range was 1 to 9 colds per year.

The median of the average number of days lost from school per cold was three days. Very often the colds continued over a week end, so the actual length of a cold would be somewhat longer than this.

The median per cent of total time lost from school because of digestive upsets was one per cent, with the middle half of the children losing from no time to 2 per cent of the days. One child, however, lost as much as 8 per cent. Thirty-two of the children, almost half, had no digestive difficulties at all.

The median amount of time lost because of "observation" was but one per cent. Nineteen children were not absent for this reason, while 1 child lost as much as 10 per cent.

There were few contagious diseases among this group. The chief cause of disability was German measles. The complete list includes ten cases of German measles; one of measles; one of cystitis; one of conjunctivitis; four children had whooping cough, three of which were immediately withdrawn from the enrollment, and therefore were not counted as absences.

## SUMMARY AND CONCLUSIONS

Descriptions have been presented of the health and development of 66 children, enrolled in the junior nursery school of the New York State College of Home Economics at Cornell University, during the five years, 1932-37. Average performance was represented by median scores, while the interquartile range was used to describe the variations of the middle half of the children and the total range to mark the outer boundaries of the group.

If the tendencies shown by the median scores of this group could have been incorporated into one child, this composite or "average" child would have had a mother 30 years old and a father 33 at the age of his birth. He would have weighed 7.63 pounds at birth (if a girl, 7.38 pounds). He would have been breast fed for 1 1/4 months. His first tooth would have appeared at 6 3/4 months and he would have walked at 14 months.

At beginning nursery school, this "average" child would be 2 years, 7 months old, weighing 33.19 pounds (31.38 if a girl). His height would be 37.3 inches (if a girl, 36.6). The weight-height index would be .88 and he would be six per cent over the New York state averages in weight for his height and age. He would also be five per cent over height for his age. His rate of gain in weight since birth would have been .76 pounds per month.

The physical examination would show this child to have fair muscular development and good tissue tone. In posture, his back would be straight with even shoulders and erect chest. The chances would be even for a prominent abdomen, one to three for knock-knees and pronated feet, one to four for eczema or patches of roughened skin, one to four for strabismus of one or both eyes, one to four for infected tonsils, though these may have been removed by the time of entering nursery school. He would have 19 teeth. His lungs and heart would be normal. His blood analysis would show hemoglobin at 81 per cent and a red cell count of 4,290,000. There would be about one out of five chances for a positive test for sugar at some time during the course of the year.

The Merrill-Palmer test would yield an I.Q. of 113.

Development during the year would show this "average" child gaining 1.9 ounces per week and .25 inches per month, with a mean deviation in weight per week of 2.93 ounces.

At the noon-meal in the nursery school, he would require 45 minutes to eat 25 units of food with an efficiency score of 81. Breadstuffs and protein would be eaten early in the meal, next would come potatoes or vegetables. Full servings, including both first and second helpings would include 3 1/3 tablespoons protein, 3 1/2 tablespoons vegetable, 4 tablespoons potato, 3 sandwiches (each equal to 1/4 slice of bread) and 7 1/2 tablespoons dessert. One cup of milk was included with the meal. On an average of 3 to 11 per cent of the time the child would take no second servings of the dinner foods, and 40 per cent of the time, no second dessert.

This "average" child would show three forms of nervous behavior per five minutes during the meal. The five most common forms would be bodily, pedal, manual, oral and vocal. The five types of nervous behavior shown least would be genital, alimentary, kinetic-repetitional, ocular and

aural. The nervous behavior would be most frequent at the middle of the meal and least at the beginning and the end.

As for sleep, the "average" child would go to his nap at 12:41 P.M., falling asleep in 20 minutes or less and sleeping 77 minutes. At night also he would fall asleep in 20 minutes or less, getting to sleep by 7:15 P.M. He would awaken in the morning at 6:52, having slept 11 hours and 27 minutes. His total sleep in twenty-four hours, including nap and night would be 12 hours and 43 minutes.

The amount of outdoor play of this "average" child would be 2 hours and 15 minutes daily, with only 2 per cent of the time that he would not be outside at all.

As for elimination, 91 per cent of the days and nights, he would be dry and 99 per cent of the time he would be dry at nap. Most of the time he would be taken up once for toilet at night. About 1 per cent of the days he would have no bowel movement. Most of the time he would have one bowel movement daily which would more likely be in the afternoon than in the morning.

Colds would cause the most sickness during the nursery school year. Sixteen per cent of the possible school days, he would be absent; 13 per cent of the days because of sickness of all kinds - 10 per cent because of colds, 1 per cent because of digestive upsets, 1 per cent because of "observation" for symptoms and 1 per cent because of other diseases or infections. He would have four colds during the year, which would cause him to lose about three days from school per cold.

In summary, it may be observed that for the most part these children were favored in their health and development. Their parents were older and they were not breast fed as long as children described in other studies; they were superior in weight at birth and weight and height at beginning school. They were early in teething, slow in walking. They were above average in mental development. They were good sleepers. There was less sickness among this group that has been described in other nursery schools.

While the median scores represent the health and development of the group, it is equally important to recognize the range of behavior which occurred among these apparently normal children.

TABLE 2

INFANT DEVELOPMENT

| | Median | Interquartile Range | Total Range |
|---|---|---|---|
| Age parents, at birth, years | | | |
| Mother | 30 | 25.5 - 34.0 | 22 - 41 |
| Father | 33 | 28.0 - 37.0 | 23 - 49 |
| Birth weight, pounds | | | |
| Girls | 7.38 | 6.56 - 8.38 | 5.69 - 10.19 |
| Boys | 7.63 | 6.88 - 8.50 | 4.88 - 10.25 |
| Feeding and development | | | |
| Breast feeding, months | 1 1/4 | 0 - 5 | 0 - 10 |
| Age, first tooth, months | 6 3/4 | 5 - 9 | 3 1/2 - 13 |
| Age, walking, months | 14 | 12 - 15 | 9 - 18 |

TABLE 3

STATUS AT BEGINNING NURSERY SCHOOL

| | Median | Interquartile Range | Total Range |
|---|---|---|---|
| Physical development | | | |
| Age, years and months | | | |
| Group | 2,7 | 2,4 - 2,10 | 1,11 - 3,3 |
| Girls | 2,7 | 2,4 - 2,10 | 1,11 - 3,3 |
| Boys | 2,7 | 2,4 - 2,10 | 2,1 - 3,2 |
| Weight, pounds | | | |
| Group | 31.95 | 29.56 - 34.63 | 26.69 - 42.0 |
| Girls | 31.38 | 28.88 - 34.38 | 26.69 - 36.81 |
| Boys | 33.19 | 29.69 - 35.19 | 27.38 - 42.0 |
| Height, inches | | | |
| Group | 37.1 | 36.0 - 38.0 | 33.3 - 41.0 |
| Girls | 36.6 | 35.5 - 37.9 | 33.3 - 39.5 |
| Boys | 37.3 | 36.4 - 38.2 | 34.3 - 41.0 |
| Over, under weight, per cent | | | |
| Group | +6 | +1 to +11 | -9 to +22 |
| Girls | +6 | +2 to +14 | -7 to +22 |
| Boys | +6 | 0 to +10 | -9 to +18 |
| Over, under height, per cent | | | |
| Group | +5 | +2 to +8 | -2 to +13 |
| Girls | +4 | +2 to +7 | -2 to +13 |
| Boys | +5 | +3 to +9 | 0 to +13 |
| Weight-height index | | | |
| Group | .88 | .82 - .93 | .75 - 1.10 |
| Girls | .87 | .82 - .93 | .75 - .99 |
| Boys | .88 | .82 - .93 | .78 - 1.10 |
| Gains in weight since birth, pounds per month | | | |
| Group | .78 | .70 - .86 | .63 - 1.05 |
| Girls | .78 | .69 - .83 | .66 - 1.02 |
| Boys | .78 | .70 - .88 | .63 - 1.05 |
| Muscular development | ++ | ++ to +++ | + to ++++ |
| Tissue tone | +++ | ++ to +++ | + to ++++ |
| Blood analysis | | | |
| Hemoglobin, per cent | 81 | 76 - 88 | 70 - 92 |
| Red cell count | 4,290,000 | 4,100,250-4,607,500 | 4,000,000-5,270,000 |
| Mental development, IQ | | | |
| Initial Merrill-Palmer test | 113 | 106 - 125 | 82 - 153 |

TABLE 4

DEVELOPMENT DURING SCHOOL YEAR

| | Median | Inter-quartile Range | Total Range |
|---|---|---|---|
| **Physical growth** | | | |
| Average gain weight per week, ounces | | | |
| Group | 1.9 | 1.5 - 2.4 | 1.0 - 5.0 |
| Girls | 2.0 | 1.7 - 2.5 | 1.2 - 3.7 |
| Boys | 1.8 | 1.4 - 2.3 | 1.0 - 5.0 |
| Average gain in height per month, inches | | | |
| Group | .25 | .23 - .29 | .03 - .40 |
| Girls | .25 | .23 - .30 | .03 - .40 |
| Boys | .25 | .23 - .28 | .15 - .32 |
| Mean deviation weight per week, ounces | | | |
| Group | 2.93 | 2.51 - 3.39 | 1.73 - 5.11 |
| **Eating behavior at noon meal** | | | |
| Measures | | | |
| Time at meal, minutes | 45 | 37 - 55 | 10 - 89 |
| Amount eaten, units | 25 | 21 - 30 | 3 - 49 |
| Efficiency | 81 | 71 - 90 | 30 - 100 and more |
| Selection of foods | | | |
| Order eating breadstuff | 2nd | 1st to 3rd | 1st to 5th |
| Order eating protein | 2nd | 2nd to 3rd | 1st to 5th |
| Order eating potato | 3rd | 2nd to 4th | 1st to 5th |
| Order eating vegetables | 3rd | 2nd to 4th | 1st to 5th |
| Amount breadstuff,* sandwiches | 3 | 2 - 4 | 0 - 9 and more |
| Amount protein,* tablespoons | 3 1/3 | 2 1/3 - 4 5/8 | 0 - 9 and more |
| Amount potatoes,* tablespoons | 4 | 3 - 5 | 0 - 9 and more |
| Amount vegetables,* tablespoons | 3 1/2 | 2 1/2 - 5 | 0 - 9 and more |
| Amount dessert,* tablespoons | 7 1/2 | 0 - 12 | 0 - 14 and more |
| Nervous behavior during meal | | | |
| Number forms per five minutes | 3 | 2 - 4 | 0 - 8 and more |
| **Sleeping behavior** | | | |
| Nap | | | |
| Time to bed, P.M. | 12:41 | 12:30 - 12:57 | Before 12:30 - 1:00 and later |
| Sleep-going, minutes | 20 and less | 21 - 40 | 0 - 41 and more |
| Total sleep, minutes | 77 | 57 - 99 | 0 - 180 and more |
| Night sleep | | | |
| Sleep-going, minutes | 20 and less | 21 - 40 | 0 - 41 and more |
| Time asleep, P.M. | 7:15 | 6:45 - 7:43 | Before 6:00 - 9:30 and later |
| Time awake, A.M. | 6:52 | 6:22 - 7:14 | Before 5:00 - 8:30 and later |
| Total sleep, hours, minutes | 11:27 | 10:56 - 12:00 | 8:25 - 13:00 and more |
| Twenty-four hour sleep | | | |
| Total sleep, hours, minutes | 12:43 | 11:59 - 13:21 | 8:25 - 15:30 |
| **Outdoor play** | | | |
| Time outside per day, minutes | 135 | 85 - 180 and more | 0 - 180 and more |
| **Elimination** | | | |
| Enuresis | | | |
| Dry day and night, per cent of time | 91 | 69 - 98 | 4 - 100 |
| Wet at nap, per cent | 1 | 0 - 4 | 0 - 23 |
| Time taken up per night | 1 | 0 - 1 | 0 - 2 and more |
| Bowel movements | | | |
| Frequency per day | 1 | 1 - 2 | 0 - 3 and more |
| Days with no movement, per cent | 1 | 0 - 3 | 0 - 18 |
| **Sickness** | | | |
| Days absent, all causes, per cent | 16 | 10 - 22 | 3 - 46 |
| Days absent, sickness, per cent | 13 | 7 - 18 | 2 - 45 |
| Days absent, colds, per cent | 10 | 6 - 16 | 2 - 44 |
| Days absent, digestive upsets, per cent | 1 | 0 - 2 | 0 - 8 |
| Days absent, "observation", per cent | 1 | 0 - 2 | 0 - 10 |
| Days absent, other diseases, per cent | 0 | 0 - 0 | 0 - 21 |
| Number colds per child | 4 | 3 - 6 | 1 - 9 |
| Average number days absent per cold | 3 | 2 - 4 | 1 - 8 |

*Total amount for the meal. First servings of 1 tablespoon each of protein food, potato and vegetable, together with 1 sandwich, 1 cup of milk and 5 tablespoons of dessert were given by the adult. Second helpings were taken by the children themselves.

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# A LONG-TERM STUDY OF CHILDREN: THE CAMBRIDGE-SOMERVILLE YOUTH STUDY

P. S. deQ. CABOT[1]

## I. ORIGINS

The Cambridge-Somerville Youth Study is a private social agency sponsored by the Ella Lyman Cabot Foundation. Founded in 1935 by Dr. Richard C. Cabot, former president of the National Conference of Social Work, the agency has as its chief objective the prevention of delinquent careers in a group of boys with whom trained and experienced counsellors will work over a period of ten years. Closely related to this objective is the equally important one of measuring the degree of success or failure in preventing delinquency. Thus treatment and research objectives are closely intertwined. Many other subsidiary researches may be carried out, such as, the causes of delinquency, longitudinal studies of personality development, the interrelationship of physical, social, mental, and emotional factors and antisocial behavior, the validation of techniques of selection, of multivariate matching procedures, of predictions of delinquency, as well as an evaluation of case records.

## II. PHILOSOPHY

Previous to the inception of the Cambridge-Somerville Youth Study, Dr. Richard C. Cabot had been impressed with the necessity for checking on the outcomes of social work particularly in the field of the prevention of delinquency (1). Many of the ideas expressed by him in his presidential address in 1931 at the National Conference of Social Work have been incorporated in the basic philosophy of the Study.

It is recognized that many criminal careers have their origins in early childhood, and that preventive work in this field should therefore deal with the young child who displays delinquent tendencies (2).

The work of the counsellor in the C.S.Y.S. is carried out in the belief that whatever can be done to favor the growth of character is thereby an effective prophylactic against later delinquency. From this viewpoint, the program can be justifiably described as one of character development. Help is given to a boy to develop as fully as possible his spiritual powers, his physical capacities, and mental abilities, and to achieve adequate emotional security and social development. To this end the C.S.Y.S. relies a great deal upon the services of churches, hospitals, schools, and social agencies with varying functions. Above all else the family is regarded as an essentially fundamental unit of society, and only in rare cases is a decision made to place a boy in a foster home. The efforts of counsellors working closely with boys on an intensive basis are integrated in a social casework relationship. By a friendly interest in a boy's problems, each counsellor hopes to supplement but not replace what would normally be a satisfactory parent-child relationship. Another principle observed is that all casework with the child be carried out in close cooperation with the public and parochial schools.

While the C.S.Y.S. program is one of treatment, carefully planned

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research procedures and methods have been followed from the beginning. It is extremely doubtful, however, whether the present stage in the work could have been reached if the approach had been simply investigational in nature and if research objectives were of primary importance. It has been understood from the beginning that if a family or a school is asked to cooperate in this attempt to evaluate casework in delinquency prevention, teachers and parents should feel that if they give information, they and the child should receive some service.

## III. METHODOLOGICAL PLAN[2]

With no precedent to follow, it was difficult at first to envisage clearly what the sequence of methodological procedures would be. At present, there are two groups of boys, approximately 325 in each. The "Treatment" group consists of those boys who will continue to receive help from a staff of counsellors for the duration of the Study, and who were no older than twelve when treatment began. Each of these boys has been "matched" as carefully as possible with another boy belonging to the other group, known as the "Control" group. The behavior of the "C" boys will be noted during the treatment period and evaluations of the behavior of the "T" and "C" groups made throughout the duration of the program. The final evaluation will take place at the termination of the treatment period. The population of each "T" and "C" group is further subdivided into three lesser groups: 1. The "difficult" or "D" group consists of boys who at the time of selection were diagnosed as likely to be delinquent; 2. The "average" or "A" group consists of boys who were diagnosed as not likely to be delinquent; 3. A so-called "zero" or "Z" group, smaller in number than either the "D" or "A" group, includes boys about whom there was considerable diagnostic and prognostic doubt. It is possible therefore to make the following comparisons within each of the "T" and "C" groups:

| | | |
|---|---|---|
| TA -- CA | TD -- CA | TZ -- CA |
| TA -- CD | TD -- CD | TZ -- CD |
| TA -- CZ | TD -- CZ | TZ -- CZ |

Comparisons of the behavior of the boys belonging to each of the "A", "Z", and "D" sub-groups within the larger "T" and "C" groups can also be made.

## IV. EVOLUTION OF THE PROGRAM

From 1935-1939, six clearly defined stages of progress may be noted:

1. Pre-Selection

After permission was obtained from the school committees of Cambridge and Somerville (Massachusetts), much work was done in interpreting the objectives of the C.S.Y.S. to social agencies and the public schools, and every precaution taken to insure as complete an understanding of the nature of the project as was possible at that time. Especially great care was taken to prevent the use of such terms "delinquent", "behavior

[2] A detailed report of the theory and techniques relating to these stages of the program will appear later.

problem", "maladjustment" when referring to any boy or group of boys then or later included in the program.

Early in the 1935-1936 school year, teachers in public and parochial schools were asked to submit the names of boys who, in their opinion, needed the kind of help the agency was prepared to offer. In addition, social agencies, community and recreational centers were asked to submit names. Schools also nominated so-called "average" boys at the time when the names of "difficult" boys were submitted, so that ages and grade placement were equivalent. Altogether 1866 boys were thus referred. Teachers then filled out specially devised rating scales, at the same time supplying more complete personality data of the boys.

Simultaneously with the collection of additional information, certain refined procedures were initiated for reducing the total number of referrals from schools and agencies.

Each boy was interviewed by the physician at the time of his physical examination, and psychologists administered various achievement and intelligence tests. The latter included group and individual tests. After a boy had been examined in the school, a woman Home Visitor interviewed the parents in their homes, explaining in simple terms the nature of the program and enlisting their cooperation. Information was obtained about the boy's developmental history, his recreational interests, attitudes in the home, the family economic circumstances, the occupational history, education, health, and personality of both parents, history of the siblings, a description of the neighborhood and home conditions, and the total family pattern as it appeared to affect the boy.

The teacher of each boy was interviewed, and social agencies, hospitals, and clinics, to whom the family was known, were consulted and reports abstracted by a field worker. Each staff member who either interviewed the boy or reviewed a particular set of data relating to him recorded his or her impressions of the boy. These ratings accompanied by a personality sketch were made by staff members independently of one another.

A very important step in the diagnostic stage of the program was a series of over-night camping trips instituted in July, 1937, under the supervision of two staff members. These boys, 47 in number, were carefully selected from the oldest group in the program at that date. The trips helped to establish cordial relationships with the boys' families, indicating that the C.S.Y.S. was anxious to offer tangible services. The impressions gained from this experiment enabled the staff to revise and to reinterpret the information on these particular boys, as well as to point the way for future diagnostic developments. Careful personality descriptions on each boy were recorded, as well as observations on each group which was never greater in number than ten nor less than five.

All the information collected by psychologists, physician, home visitor, and teacher interviewer, as well as that obtained from rating scales, social agency contacts, and other sources, constituted the folder content which was submitted to a selection committee composed of a psychiatrist and two social workers.

All forms, rating scales, and procedures used in the "pre-selection" stage of the program were adopted only after they had been submitted to the closest scrutiny and after they had been used on small try-out groups of boys.

2. Selection of Boys

In addition to many preliminary conferences, twenty-five meetings of the Selection Committee were held from October, 1937, to January, 1939. Each member of the committee reviewed the folder content independently of his colleague, and when a particular set of cases was surveyed, a round table conference on each boy was held before a final decision was made. Where complete agreement on the final disposition of each boy was impossible, a particular technique was devised whereby majority and minority decisions were recorded. 782 boys were selected of whom 360 were diagnosed as "difficult", 334 as "average", and 88 as belonging to the "zero" group.

3. Matching

Despite the seemingly insuperable difficulties involved in matching or pairing boys, a matching committee of three staff members proceeded to find "diagnostic twins".

The folder content of each boy was carefully analyzed and transferred to code data sheets so arranged that the data were broken down into approximately 160 separate items grouped under such categories as general and medical information, developmental and personality data, educational and mental status, personality ratings, and final disposition.

After a searching clinical review of the code data sheets - the actual pairing process - the information on boys thus matched tentatively was transferred in numerical form to analysis sheets and grouped in accordance with a definite conceptual scheme. Examples of the variables noted on the analysis sheet are: chronological age, dominant stock, birthplace of each parent, religion, locality, school, grade placement, physical health, intelligence, attainment, and educational quotients, mental health, social adjustment, judgments of the selection committee, home ratings, standard of living, occupational status of father, neighborhood, school occupational level, etc. Descriptive reports were made together with a summary of conclusions and reasons for the match. 650 boys were finally matched, of whom 325 constituted the "Treatment" group and a similar number the "Control" group.

4. Assignment

After the population selected by the Selection Committee had been exhausted in the matching process, an arbitrary division of boys into "T" and "C" groups was made. The assignment of cases to counsellors, many of whom are trained social workers and others of whom have had considerable experience with adolescents and young boys, began November 12, 1937, and finished May 13, 1939.

When boys were assigned to counsellors, due attention was paid to many factors such as, the boy's age, school attended, personality, apparent needs, the qualifications and sex of the counsellor, the place of the boy's residence. For a full-time counsellor, the average case-load was approximately thirty-four.

5. Treatment

June 1, 1939 was arbitrarily set as the date when treatment began after the last case had been assigned. Owing to the fact that five boys have moved to places where effective treatment by the staff is impossible and that two boys have died, the present number of the total treatment case load is 318.

The following is a summary of the C.S.Y.S. treatment program during 1939:

TABLE 1

NUMBER OF INTERVIEWS MADE BY COUNSELLORS DURING 1939

| Individual or Agency Interviewed | Number |
|---|---|
| Families | 2353 |
| Boys | 2717 |
| School | 1119 |
| Social Agencies | 521 |
| Settlements, etc. | 236 |
| Hospitals | 485 |
| Delinquency Squad and Police | 117 |
| Probation Officers | 59 |
| Court | 23 |
| Inter-Staff (C.S.Y.S.) | 577 |
| Miscellaneous | 276 |
| Total | 8483 |

TABLE 2

SUMMARY OF SERVICES DURING 1939

| Services | Number of Individuals | Services | Number of Individuals |
|---|---|---|---|
| Psychological | | Family Problems | |
| Testings | 60 | Economic | |
| Remedial Work | 30 | Cash | 14 |
| Referred for further tests | 92 | Clothing | 21 |
| | | Advice | 85 |
| Psychiatric | 22 | Employment | 61 |
| | | Personal Adjustment | |
| Educational | | Behavior | 131 |
| | | Marital | 25 |
| School | 279 | Others | 67 |
| Boy | 216 | Health | 105 |
| Family | 183 | Foster Home Placements | 7 |
| Other | 28 | Miscellaneous | 35 |
| Recreation | | Religious | |
| Settlements, etc. | 102 | Church Duties | 33 |
| Trips, etc. | 267 | Priests, etc. | 39 |
| Special Training | 50 | Others | 23 |
| Hobbies | 45 | Health | |
| Camps | 109 | General Physical | 80 |
| | | Special Examinations | 96 |
| | | Treatment Plans | 119 |
| | | Dental Examinations | 55 |
| | | Dental Treatment | 25 |

Some of these specialized services that could not be provided directly by this organization have been given by 88 cooperating agencies in greater Boston, including clinics, hospitals, child welfare organizations, state departments, etc.

When a family moves to another locality, the cooperation of that particular school system is enlisted. At present, 10 school systems are cooperating with the agency. The following is a distribution of the total number of boys in the program among public and parochial schools in Cambridge and Somerville.

TABLE 3

DISTRIBUTION OF BOYS IN CAMBRIDGE AND SOMERVILLE BY SCHOOLS

| Cambridge | No. of Schools | No. of Boys |
|---|---|---|
| Public | 21 | 356 |
| Parochial | 10 | 65 |
| Somerville | | |
| Public | 28 | 180 |
| Parochial | 3 | 7 |

The remaining 36 boys of the C.S.Y.S. population attending public or parochial schools are located in the 10 other school systems in Massachusetts.

Regular monthly case conferences are held between the director and each member of the counselling staff. In addition, the services of a case consultant are available. Monthly meetings are held with a casework committee consisting of three staff members of social agencies in greater Boston. In addition to regular staff and counsellors meetings, staff seminars coordinate the agency's thinking and practices.

6. "Control" Program

The determination of the program of the supervisor of the "Controls", whose responsibility is to collect, integrate, and interpret data on the "C" boys, resides in two sets of factors: 1. the general objectives of the agency; 2. the degree of difficulty encountered in attempts to obtain relevant material. A beginning has been made in paralleling the construction and development of the records on the "C" boys. The kind of information so far obtained on the "C" boys refers to school progress, actual apprehended delinquency, community relationships, personality development, agency contacts, special psychological tests, and medical examinations. This is done through interviews with teachers, probation officers, church officials, agency representatives, members of the treatment staff whose "T" boys may be friends of "C" boys, and summer camp directors.

As the possibilities for obtaining information develop, an extension of the present schedule for the supervisor of the "Controls" is possible concerning sources of information, the times and methods of collecting data, manner of recording, and office procedures affecting disposition and filing.

## V. RESEARCH

Arising from the formulation of research questions, counsellors incorporate within their case records data which may be additional to that required for treatment purposes but which is necessary for the attempted solution of problems concerned with personality development, with the development of community relationships, or with topics concerning school progress, emotional maturity, medical, and orthopsychiatric problems, and periodic cross-sectional analyses of data on both "T" and "C" boys. It is probable that such analyses will be made at periods of no less than two or no more than three years within the originally planned ten-year period. By this procedure, the final labors of evaluation should be considerably reduced.

## VI. ORGANIZATION

At present, the staff is composed of one director, nine counsellors, many of whom are graduates of schools of social work, one associate counsellor, one casework consultant, two psychologists, four volunteer tutors, one supervisor of "Controls", one secretary, and five members of the secretarial staff including a research assistant.

A general Advisory Committee consists of the following:

Dr. William Boyd, Lecturer in Education, University of Glasgow, and Director of the Child Guidance Clinic connected with the Department of Education, Glasgow, Scotland.
Dr. Stanley Cobb, Bullard Professor of Neuropathology, Harvard Medical School.
Dr. Donald J. MacPherson, psychoanalyst and psychiatrist, Boston; Instructor in Neuropathology, Harvard University.
Prof. H. A. Murray, Jr., Associate Professor of Psychology, Harvard Psychological Clinic, Harvard University.
M. le Prof. Jean Piaget, Institut des Sciences de L'Education, Université de Genève, Geneva, Switzerland.
Dr. E. C. Romberg, practising pediatrician, Boston; Lecturer in Pediatrics, Massachusetts General Hospital; Instructor in Pediatrics, Harvard University.
Dr. A. Warren Stearns, neurologist and psychiatrist; Dean of Tufts Medical School, Boston.
Dr. D. A. Thom, psychiatrist; Director of West End Habit Clinic, Boston.
Prof. Gordon W. Allport, Associate Professor of Psychology, Harvard University.
Mrs. Edith M. H. Baylor, Supervisor, Department of Study and Training, Children's Aid Association, Boston.
Prof. Phillip J. Rulon, Assistant Professor of Education, Harvard University.
Prof. Hadley Cantril, Associate Professor of Psychology, Princeton University.
Prof. E. A. Hooton, Professor of Physical Anthropology, Harvard University.

A treatment Advisory Committee is composed of the following:

Mrs. Edith M. H. Baylor.
Right Rev. Augustine F. Hickey, Pastor of St. Paul's Parish, Cambridge.
Dr. Augusta Bronner, Co-Director, Judge Baker Guidance Center, Boston.
Dr. William Healy, Co-Director, Judge Baker Guidance Center, Boston.
Mr. Cheney Jones, Superintendent, New England Home for Little Wanderers, Boston.
Mr. Theodore Lothrop, General Secretary, Massachusetts Society for the Prevention of Cruelty to Children, Boston.
Mr. Alfred F. Whitman, General Secretary, Children's Aid Association, Boston.

The closest possible relationship has been established with the two chief school systems, namely, Cambridge and Somerville, through two liaison officers, Miss Gertrude B. Duffy, Supervisor of Mental Tests and Measurement, Cambridge, and Mr. Everett W. Ireland, Superintendent of Schools, Somerville.

The following are some of the outstanding characteristics of this program of character development and delinquency prevention:

1. The selection of a group of "Control" boys who were initially matched or paired with boys in the "Treatment" group;
2. The inclusion of "average" boys in both "Treatment" and "Control" groups;
3. The selection of a typical cross-section of an American public and parochial school population;
4. The importance of the personal influence of well-trained and experienced counsellors upon the boy;
5. Long-time and continuous treatment of boys during the pre-adolescent, adolescent, and early adult years;
6. As much as possible, prevention of the development of problems of delinquent behavior rather than the treatment of symptoms of delinquency;
7. The inclusion of parochial schools;
8. The demonstration of a continuous plan of coordination of social agencies, summer camps, the school, and the home, in the interests of the individual boy;
9. The value of parental education with an attempt to maintain, wherever possible, the integrity of family relationships;
10. The importance of integrating a tutoring and a remedial reading program with casework procedures;
11. The combination of research and casework;
12. Careful planning for purposes of evaluation;
13. The basic philosophy of the program.

CABOT: CAMBRIDGE-SOMERVILLE YOUTH STUDY

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